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QUARTERLY JOURNAL

OF

THE METEOROLOGICAL SOCIETY.

VOL. III. No. 17.

I. *Some Remarks on the reduction of Barometric Readings, with a form of Table for combining the corrections for Index Error, Temperature, and Altitude.* By WILLIAM MARRIOTT, Assistant Secretary.

[Received October 18th. Read November 17th, 1875.]

EVERY observed reading of the Barometer, to be of any scientific value, requires to be corrected for index error, temperature, and height above the mean sea-level. The correction for index error is obtained by comparing the Barometer with a recognised standard instrument, *e.g.* the Kew Standard; while that for temperature and that for height above sea level are given in most meteorological works with tables. There is not much difficulty in applying the first two; but it is a very troublesome thing to make the proper corrections for altitude if the station be more than 100 feet above sea level.

In examining some returns that have been sent to the Society, I have come across some very extraordinary mistakes which have been made, even by good observers, in reducing their barometer readings, as will be seen by the following statements:—

One applied a constant correction of the height of his barometer in feet above sea level.

A second took out the corrections from the altitude table, using the readings of the attached thermometer for the "temperature of the air."

A third adopted the reading of a thermometer in the room where the barometer was situated for the "temperature of the air."

A fourth took out the corrections for 30 inches only, and made no allowance for variation in pressure.

A fifth gave his height above sea level incorrectly, consequently all his reduced readings were wrong.

The explanation accompanying the Tables of corrections for altitude, as

given in the different works on Meteorology, is by no means satisfactory. It is simply stated that the corrections are for pressures at the lower station; but no hint is given as to how the corrections for the upper, or observer's, station are to be obtained.

Then, again, the Tables are only given for two pressures, viz.:—30 inches and 27 inches; consequently one has to go through some calculations before he can get the correction for any intermediate reading. For my own part, I cannot see why 27 inches should have been adopted, for one never hears of readings so low as 27 inches at the *sea level*. A Table at 29 inches would be infinitely better, and the corrections for lower pressures could be obtained quite as easily as at present, if not more so.

When examining the returns sent in to the Society, I generally use a Table giving the corrections for altitude for every tenth of an inch pressure from 28·7 in. to 30·6 in., and each 10° of temperature from 20° to 80°.

Table I. is a specimen of the form used for Crowborough Beacon, 828 feet above sea level.*

TABLE for Reducing Observations of the

BAROMETER TO SEA LEVEL.

Crowborough Beacon, 828 feet.

Sea Level Pressure.	Temperature of Air (*i.e.* Dry Bulb.)							Reading of Barometer at 828 feet.
	20°	30°	40°	50°	60°	70°	80°	
In.	In.	In.	In.	In.	In.	In.	In.	In.
30·6	+·978	+·957	+·937	+·916	+·897	+·880	+·862	29·7
·5	·975	·954	·934	·913	·894	·877	·859	·6
·4	·972	·951	·931	·910	·891	·874	·856	·5
·3	·968	·947	·927	·907	·888	·871	·854	·4
·2	·965	·944	·924	·904	·885	·868	·851	·3
·1	·962	·941	·921	·901	·882	·865	·848	·2
30·0	·959	938	·918	·898	·879	·862	·845	·1
29·9	·956	·935	·915	·895	·876	·859	·842	29·0
·8	·952	·931	·911	·892	·873	·856	·840	28·9
·7	·949	·928	·908	·889	·870	·853	·837	·8
·6	·946	·925	·905	·886	·867	·850	·834	·7
·5	·943	·922	·902	·883	·864	·847	·831	·6
·4	·940	·919	·899	·880	·861	·844	·828	·5
·3	·936	·916	·896	·877	·859	·842	·826	·4
·2	·933	·913	·893	·874	·856	·839	·823	·3
·1	·930	·910	·890	·871	·853	·836	·820	·2
29·0	·927	·907	·887	·868	·850	·833	·817	·1
28·9	·924	·904	·884	·865	·847	·830	·814	28·0
·8	·921	·901	·881	·862	·844	·827	·811	27 9
·7	·918	·898	·878	·859	·841	·824	·808	·8

*The values in this and the succeeding Table are taken from 'Instructions in the use of Meteorological Instruments,' by ROBERT H. SCOTT, F.R.S., London, 1875.

The chief feature in this Table is, that while the sea level pressure is given in the column on the left hand, the reading of the barometer at the station, corresponding to that pressure, is given in the column on the right hand.

The application of these several corrections, however, takes a long time, besides the labour being very great. What is required is, to have a Table combining all three corrections, so that the barometer reading can be reduced at once. Such a form of Table, which has been devised by the Rev. F. W. Stow, M.A., (who has kindly placed it at my disposal,) can be used for all ordinary pressures and temperatures.

It will be seen in the preceding Table that a change of 0·6 inch in the pressure of the air produces the same amount of variation in the correction for altitude as is produced by an alteration of 10° in the temperature of the air. For instance, the correction for altitude, when the pressure is at 29·8 in., and the temperature of the air 70°, is the same as that when the pressure is 29·2 in., and the temperature 60°. By taking a mean height of the barometer, we can combine the correction for temperature with that for altitude; and when the index error is the same throughout the scale, (as in Fortin's barometer,) it can also be included.

Some might possibly take exception to the adoption of a mean height of the barometer, as a possible means of producing a large error. But it will be seen by reference to the Table for the correction for temperature, that at 76° the difference between the correction for 30·5 in. and for 29·0 in. is ·006 in.; consequently the error is only ·008 inch, which is scarcely appreciable, and quite within an allowable limit.

Table II. (page 4) is a copy of the form used for Calcethorpe, Louth, 882 feet above sea level. (The correction for index error is + ·020 inch.)

To use the Table.—Look in the column on the right or left, in the upper portion of the Table, for the reading of the barometer at the station, and carry the eye horizontally to the temperature of the air, (*i.e.* dry bulb reading,) and then vertically downwards, and through the corresponding column in the second half of the Table, until the value horizontally opposite the temperature of the attached thermometer is the required correction.

TABLE II.

CALCETHORPE, 382 FEET.

Combined Correction for Index Error, Temperature and Altitude.

Barometer Reading at Station.	Temperature of Air (*i.e.* Dry Bulb).																															Barometer Reading at Station.
In.	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	In.
30·20	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	92	94	96	98	100	30·20
·14	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67	69	71	73	75	77	79	81	83	85	87	89	91	93	95	97	99	·14
·08	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	92	94	96	98	·08
30·02	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67	69	71	73	75	77	79	81	83	85	87	89	91	93	95	97	30·02
29·96	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	92	94	96	29·96
·90	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67	69	71	73	75	77	79	81	83	85	87	89	91	93	95	·90
·84	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	92	94	·84
·78	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67	69	71	73	75	77	79	81	83	85	87	89	91	93	·78
·72	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	92	·72
·66	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67	69	71	73	75	77	79	81	83	85	87	89	91	·66
·60	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	·60
·54	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67	69	71	73	75	77	79	81	83	85	87	89	·54
·48	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	·48
·42	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67	69	71	73	75	77	79	81	83	85	87	·42
·36	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84	86	·36
·30	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67	69	71	73	75	77	79	81	83	85	·30
·24	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84	·24
·18	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67	69	71	73	75	77	79	81	83	·18
·12	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82	·12
·06	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67	69	71	73	75	77	79	81	·06
29·00	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	29·00
28·94	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67	69	71	73	75	77	79	28·94
·88	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	·88
·82	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67	69	71	73	75	77	·82
·76	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	·76
·70	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67	69	71	73	75	·70
·64	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	·64
·58	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67	69	71	73	·58
·52	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	·52
·46	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67	69	71	·46
28·40	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	28·40

Attached Thermometer.	Correction to be *added* to Reading of Barometer.																													Attached Thermometer.
°																														°
30	·452	·450	·448	·447	·445	·443	·441	·439	·438	·436	·434	·432	·431	·429	·427	·426	·424	·423	·421	·419	·418	·416	·414	·413	·411	·409	·407	·406	·404	·403	·401	30
32	·447	·445	·443	·442	·440	·438	·436	·434	·433	·431	·429	·427	·426	·424	·422	·421	·419	·418	·416	·414	·413	·411	·409	·408	·406	·404	·402	·401	·399	·398	·396	32
34	·441	·439	·437	·436	·434	·432	·430	·428	·427	·425	·423	·421	·420	·418	·416	·415	·413	·412	·410	·408	·407	·405	·403	·402	·400	·398	·396	·395	·393	·392	·390	34
36	·436	·434	·432	·431	·429	·427	·425	·423	·422	·420	·418	·416	·415	·413	·411	·410	·408	·407	·405	·403	·402	·400	·398	·397	·395	·393	·391	·390	·388	·387	·385	36
38	·431	·429	·427	·426	·424	·422	·420	·418	·417	·415	·413	·411	·410	·408	·406	·405	·403	·402	·400	·398	·397	·395	·393	·392	·390	·388	·386	·385	·383	·382	·380	38
40	·426	·424	·422	·421	·419	·417	·415	·413	·412	·410	·408	·406	·405	·403	·401	·400	·398	·397	·395	·393	·392	·390	·388	·387	·385	·383	·381	·380	·378	·377	·375	40
42	·420	·418	·416	·415	·413	·411	·409	·407	·406	·404	·402	·400	·399	·397	·395	·394	·392	·391	·389	·387	·386	·384	·382	·381	·379	·377	·375	·374	·372	·371	·369	42
44	·415	·413	·411	·410	·408	·406	·404	·402	·401	·399	·397	·395	·394	·392	·390	·389	·387	·386	·384	·382	·381	·379	·377	·376	·374	·372	·370	·369	·367	·366	·364	44
46	·410	·408	·406	·405	·403	·401	·399	·397	·396	·394	·392	·390	·389	·387	·385	·384	·382	·381	·379	·377	·376	·374	·372	·371	·369	·367	·365	·364	·362	·361	·359	46
48	·404	·402	·400	·399	·397	·395	·393	·391	·390	·388	·386	·384	·383	·381	·379	·378	·376	·375	·373	·371	·370	·368	·366	·365	·363	·361	·359	·358	·356	·355	·353	48
50	·399	·397	·395	·394	·392	·390	·388	·386	·385	·383	·381	·379	·378	·376	·374	·373	·371	·370	·368	·366	·365	·363	·361	·360	·358	·356	·354	·353	·351	·350	·348	50
52	·394	·392	·390	·389	·387	·385	·383	·381	·380	·378	·376	·374	·373	·371	·369	·368	·366	·365	·363	·361	·360	·358	·356	·355	·353	·351	·349	·348	·346	·345	·343	52
54	·389	·387	·385	·384	·382	·380	·378	·376	·375	·373	·371	·369	·368	·366	·364	·363	·361	·360	·358	·356	·355	·353	·351	·350	·348	·346	·344	·343	·341	·340	·338	54
56	·383	·381	·379	·378	·376	·374	·372	·370	·369	·367	·365	·363	·362	·360	·358	·357	·355	·354	·352	·350	·349	·347	·345	·344	·342	·340	·338	·337	·335	·334	·332	56
58	·378	·376	·374	·373	·371	·369	·367	·365	·364	·362	·360	·358	·357	·355	·353	·352	·350	·349	·347	·345	·344	·342	·340	·339	·337	·335	·333	·332	·330	·329	·327	58
60	·373	·371	·369	·368	·366	·364	·362	·360	·359	·357	·355	·353	·352	·350	·348	·347	·345	·344	·342	·340	·339	·337	·335	·334	·332	·330	·328	·327	·325	·324	·322	60
62	·368	·366	·364	·363	·361	·359	·357	·355	·354	·352	·350	·348	·347	·345	·343	·342	·340	·339	·337	·335	·334	·332	·330	·329	·327	·325	·323	·322	·320	·319	·317	62
64	·362	·360	·358	·357	·355	·353	·351	·349	·348	·346	·344	·342	·341	·339	·337	·336	·334	·333	·331	·329	·328	·326	·324	·323	·321	·319	·317	·316	·314	·313	·311	64
66	·357	·355	·353	·352	·350	·348	·346	·344	·343	·341	·339	·337	·336	·334	·332	·331	·329	·328	·326	·324	·323	·321	·319	·318	·316	·314	·312	·311	·309	·308	·306	66
68	·352	·350	·348	·347	·345	·343	·341	·339	·338	·336	·334	·332	·331	·329	·327	·326	·324	·323	·321	·319	·318	·316	·314	·313	·311	·309	·307	·306	·304	·303	·301	68
70	·347	·345	·343	·342	·340	·338	·336	·334	·333	·331	·329	·327	·326	·324	·322	·321	·319	·318	·316	·314	·313	·311	·309	·308	·306	·304	·302	·301	·299	·298	·296	70
72	·341	·339	·337	·336	·334	·332	·330	·328	·327	·325	·323	·321	·320	·318	·316	·315	·313	·312	·310	·308	·307	·305	·303	·302	·300	·298	·296	·295	·293	·292	·290	72
74	·336	·334	·332	·331	·329	·327	·325	·323	·322	·320	·318	·316	·315	·313	·311	·310	·308	·307	·305	·303	·302	·300	·298	·297	·295	·293	·291	·290	·288	·287	·285	74
76	·331	·329	·327	·326	·324	·322	·320	·318	·317	·315	·313	·311	·310	·308	·306	·305	·303	·302	·300	·298	·297	·295	·293	·292	·290	·288	·286	·285	·283	·282	·280	76
78	·326	·324	·322	·321	·319	·317	·315	·313	·312	·310	·308	·306	·305	·303	·301	·300	·298	·297	·295	·293	·292	·290	·288	·287	·285	·283	·281	·280	·278	·277	·275	78

DISCUSSION.

Mr. BRIGGS said he could bear testimony to the accuracy of the Table. Mr. Marriott had sent him a copy of that for Calcethorpe Manor, which he had used and found most time-saving. He had worked out his barometer readings with this Table, and also with the three separate corrections, and found the difference only ·001 in. or ·002 in.

Mr. SYMONS said he could confirm the remarks of Mr. Briggs on the accuracy of the Table. Mr. Marriott had a happy knack of finding short cuts, and preventing a great deal of unnecessary trouble. It was only last year that he brought forward his Dew Point Table, which effected a saving of 30 per cent. of time as compared with other Tables, and now he has brought forward this Table, which he (Mr. Symons) was sure would be the means of saving 60, if not 70, per cent. of the time employed in using the other Tables. In this all the three processes are thrown into one; consequently the liability to error is greatly reduced. He thought that the Society was greatly indebted to Mr. Marriott for the labour and care he had bestowed upon the Returns sent in to the Society, of which the present Table was a result. There was one thing which Mr. Marriott had not alluded to, viz. that the amount of work in making the Table was very great.

Mr. C. HARDING said that no such Table had been used at the Land Stations of the Meteorological Office; but for sea observations, where the height of the barometer is only 10 or 20 feet above sea level, a similar table had been used including also the index error of the barometer. This could easily be done, as a constant correction for altitude could be used, and generally the air temperature on board ship varied but little, 60° being adopted for the formation of the Table.

Mr. MARRIOTT said that he had used these Tables now for some months, and found that they had been the means of saving much time and labour, besides greatly reducing the liability to error. He had frequently compared the results obtained by this Table, and by the three separate processes, and found that they always agreed to the amount stated in the Paper. He was constantly receiving letters from observers, asking how their readings should be reduced; he thought that this arose from the unsatisfactory explanation accompanying the Tables. He was of opinion that three-quarters of the observations already made were useless, because they were not properly corrected. He wished that some one could induce the observers to correct their readings in a proper manner. His object in bringing the Paper before the Society was, that the observing Fellows might have the benefit of his experience.

II. *On a Continuous Self-registering Thermometer.* By W. HARRISON CRIPPS. (Communicated by R. H. SCOTT, F.R.S.)

[Received October 20th. Read November 17th, 1875.]

THE Thermometer shown to the Society is similar in principle to one exhibited at the Royal Society in April last. The detail of the instrument has, however, been somewhat modified.

The object of the instrument is to obtain a continuous registration of heat with a Thermometer that shall not be liable to error by oxidation or evaporation of the mercury or spirit.

The instrument consists of two portions:—1st, the Thermometer for indicating the temperature. 2nd, the Clock-work for registering the hours and minutes.

The Thermometer consists of six coils of glass tubing, the first five coils being wound concentrically round an axis, each coil lying within the other in such a manner as to form a spiral glass wheel 4 inches in diameter. The

sixth and last coil is moved slightly away from the others, so that it shall form the circumference of a circle five inches in diameter, the centre of this circle being the axis around which the spiral tube is coiled.

To each end of the axis a fine needle-pointed pivot is attached. These pivots rest on minute depressions between two parallel metal uprights.

It will be seen from this arrangement that the glass wheel can rotate freely between the uprights; and the pivots will be the centre of a circle, the circumference of which is formed by the last coil of the glass wheel.

The coils of tubing forming the glass wheel are filled with spirit at 60° Fahr. The quantity of spirit is such that it fills the spiral portion of the tubing, and also 3 or 4 inches of the last coil (or the one forming the circle). Mercury is then passed into the tube till it comes into contact with the spirit, and in such quantity as to fill up about 4 inches of the remaining portion of the tube. The spirit is then heated, and on expanding forces the column of mercury in front of it. When the mercury is within two inches of the termination of the circle, the tube is hermetically sealed, enclosing a small quantity of air.

If the Thermometer be now arranged with its needle points between the uprights, it will be observed that as the spirit contracts on cooling, the expansion of the included air keeps the column of mercury in contact with it. This immediately alters the centre of gravity, and the wheel begins to revolve in a direction opposite to that of the receding mercury. On applying heat, the mercury passes forward, and the wheel regains its original position. By this arrangement the two forces, heat and gravity, acting in contrary directions, generate a steady rotary motion.

The method by which this movement is made serviceable is the following: A grooved wheel two inches in diameter is fixed to one of the pivots, and therefore revolving with the Thermometer. Fixed to and passing over this wheel is a fine thread, from which is suspended a tiny pencil holder, moving up and down on a vertical slide. The pencil will be raised or lowered according to the direction in which the wheel is moving. The other portions of the clock-work are arranged in a manner similar to that employed in the Barograph.

In the present instrument a cylinder 4½ inches, both in width and diameter, is made to revolve once in seven days. Around this cylinder is placed a paper, on which the days and hours are indicated by vertical lines. The cylinder is so placed that the surface of the paper is $\frac{1}{10}$th of an inch away from the pencil point, moving at right angles to its surface. A small striker is connected with the clock-work in such a manner that at every quarter of an hour it gives the pencil a gentle tap, thus striking its point against the paper. By this means all friction of the moving pencil against the paper is avoided, and the record marked by a series of dots.

The scale for reading off the register is prepared by observing the extent to which the pencil rises for every 10°, as indicated by a standard thermometer. In this particular instrument it is found, that for every 10° the pencil is raised ¾ of an inch; this gives $\frac{3}{40}$ths for each degree, and the index is accordingly divided to this scale.

No opportunity has occurred of noting the rise of the pencil above 75° or below 45°, but within this range there is no appreciable difference in the relative rise for each 10°. That is to say, that for each of the three periods between 45° and 55°, between 55° and 65°, and between 65° and 75° the rise is ¾ of an inch in each case. Possibly, in wider ranges of temperature, either from inequality in the glass, or the unequal expansion of spirit, the rise or fall would not be exactly ¾ of an inch for each 10°.

But such variation would be immaterial, for the error could be accurately determined by comparison with a Standard Thermometer, and could be marked on the moveable scale supplied with the instrument for reading the register.

DISCUSSION.

Mr. CRIPPS said that he had not used the instrument in the open air, but had no doubt that it would work satisfactorily out of doors if the thermometer were placed on the outside of the case. He had found that the record was about a quarter of an hour slow; this, he believed, was due to the quantity of spirit employed, which rendered the instrument rather sluggish.

CAPT. TOYNBEE said that the instrument only recorded every quarter of an hour; he thought that, for use in Meteorology, it should record at least every minute, as great changes of temperature frequently occur in very short spaces of time. He understood from Mr. Cripps that this change could be made in it. If the instrument could be made to work continuously, it would be a great advantage.

Mr. SCOTT remarked that there would probably be some difficulty in obtaining a continuous record of the temperature, for the friction of the pencil against the drum would interfere with the sensitiveness of the instrumental arrangements.

Mr. WHIPPLE asked how nearly the instrument will come back to the same place after a change of temperature?

Mr. GASTER asked what the probable cost of the instrument would be?

Mr. SYMONS said that it appeared to be a beautifully made and very pretty instrument; but he thought the best place for it at present would be in the drawing-room, for it was not suitable for outdoor use. He would like to know how it would work when exposed to London blacks. What is required is to have a cheap and reliable thermograph, for meteorologists, as a rule, are not very rich. There was also a disadvantage in using a spirit thermometer, viz. the disengagement of air, which would break up the column; but in this particular instrument it might possibly only cause a change of zero point, and therefore be easily overcome.

Mr. CASELLA said they were not only indebted to Mr. Cripps for the invention of this instrument, but to his great perseverance, also, in carrying it out. At first he (Mr. Casella) was unwilling to undertake its construction, for he found, as a rule, that carrying out inventions were not desirable undertakings; but in this instance he could not resist. Doubts having been expressed as to the adaptation of the instrument for outdoor use, he might remind them that at Kew there were much more costly Thermographs so arranged as to have the bulbs of the Thermometers out of doors, and the indicating portion of the instrument within. This course, at least, could easily be adopted with the present instrument, though he believed it could be perfectly arranged so as to use the whole instrument out of doors; and as to its portability, that also could be arranged with perfect safety and ease. The cost of the present instrument was comparatively great, but he was glad to believe they could be so arranged as to be made at a very moderate price.

Mr. CRIPPS said that he had found the pencil mark had come back to the same place after a change of temperature. He had frequently found this the case at 60°. He had been informed by Mr. Casella that the probable cost of future instruments

would be about 16 or 18 guineas. With reference to the London blacks, he thought that the pivots might be occasionally cleaned, or protected by small metal shields.

III. *On a Self-regulating Atmometer.* By Samuel H. Miller, F.R.A.S., F.M.S.

[Received November 1st. Read November 17th, 1875.]

After several years' experimenting with evaporating dishes of different forms under various conditions, I have arrived at the conclusion that none of the contrivances which have come under my own observation are entirely satisfactory.

The ordinary open gauges are not only not precise in their indications, but are defective in many respects. The height of the water is variable. In dry seasons it may become so low in the vessel as to be considerably sheltered from the passing currents of air; and in times of heavy rain there is the danger of overflow if the water be kept too near the rim of the gauge; the outsplashing, too, may then considerably vitiate the results.

Dr. von Lamont's apparatus, as described in Professor Ebermayer's work on "The Physical Influences of Forests on the Air and Soil,"* appeared to me a very ingenious contrivance, yet more adapted for laboratory work than for exposure in the open air. Besides, the exposed surface is somewhat screened on one side, and the whole arrangement is useless in frosty weather.

An atmometer, to be really efficient, must be able to show the evaporation when the surface is frozen. I have found an appreciable quantity of vaporization from a surface of ice—as, for instance, in 24 hours, when the mean temperature of the air was below the freezing point, as much as 0·018 inch was evaporated. Therefore an evaporator which cannot be exposed during the winter months will fail to do a complete year's work.

Again, if the evaporation is estimated merely by measuring the residual water in the gauge with a graduated jar, difficulties must often present themselves in winter if frequent observations are to be made. Professor Osnaghi's atmometer indicates the evaporation by the loss in weight of a vessel containing water†—and all things being considered, I conclude that weighing is the most accurate means of estimating evaporation from small vessels.

An evaporating apparatus described in *Symons's British Rainfall*, 1870, page 178, as "Miller's Sand Evaporator," has been used by me for several years, and has given results closely comparable with those from a large tank; but this instrument requires close watching to prevent overflowing, unless sufficient space be allowed for the heaviest possible rainfall.

* "Die Physikalischen Einwirkungen des Waldes auf Luft und Boden." Aschaffenburg, 1873.

† *Vide* "Instructions in the use of Meteorological Instruments," by R. H. Scott, M.A., F.R.S. p. 53. London, 1875.

Judging from all that I can gather from the reports of Congresses and from Mr. Scott's "Instructions" recently issued, I find that a trustworthy "atmometer"— such an one as is especially suited for stations of the "second order"—is still a great *desideratum*. It is certain that tanks like that used for some time past at Strathfield Turgiss (for the past two years I have used a tank holding 500 gallons of water, and from which I take daily records of evaporation), cannot be brought into general use. If it were required to ascertain the rate of evaporation at different elevations on a hill side, the tank would be quite impracticable. The fact is, we want a handy, portable instrument.

In devising the atmometer I am about to describe, I have striven to avoid the defects found in others and to supply that in which they are deficient, and at the same time have endeavoured to make it as simple in its action and use as possible. The first consideration was, that the instrument should be suited to all seasons and to any amount of exposure without the risk of being deranged; and the next, that as water is evaporated from the exposed surface, more water should flow in to maintain a constant level, and that as rain falls it should be allowed to flow into a reservoir and be retained there.

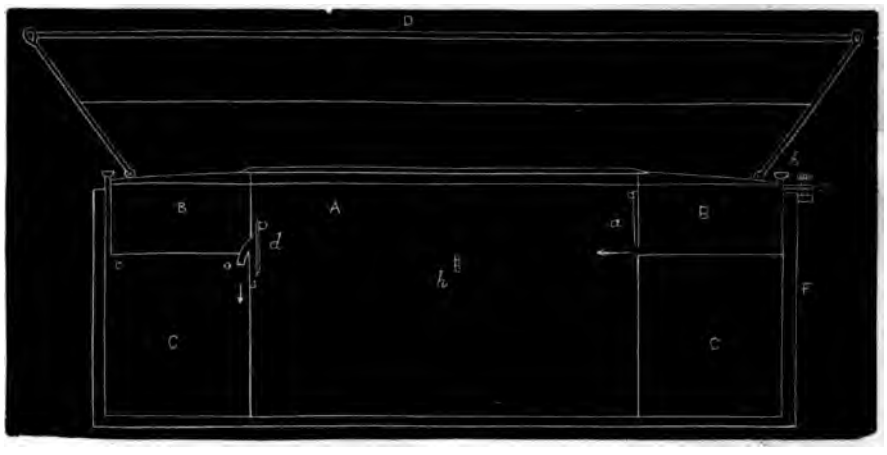


FIG I.

Fig. I.– A is an open cylinder of eight inches diameter, surmounted by a brass rain-gauge rim, and receives the water from which the evaporation takes place. This vessel is surrounded by another cylinder of 15 inches diameter closed at the top. This outer cylinder is divided into two compartments, upper and lower, and marked B and C. These run completely round the inner cylinder. Compartment B is filled with water through an aperture *b*, which is fitted with an air-tight screw cap.

Compartment C is the receiver of the overflow rainfall, and is emptied through the pipe *c*, to which is fitted a screw cap similar to *b*. (By turning this screw back two or three threads a small hole is exposed through which the

air passes as the water flows in; by this means the escape of vapour from the lower compartment is reduced to a minimum.)

At *a* is a small *slide-valve* which is closed when chamber B is filled with water, and opened when cap *b* has been screwed down and the instrument is put into operation. *d* is another *slide-valve*, which is opened after the atmometer is set.

o is the overflow pipe which conveys the rain water from cylinder A. The aperture of valve *d* is lower than the termination of pipe *o*, and therefore the overflow pipe cannot act as a syphon from A to C. The aperture is below the constant surface of the water in A, to prevent evaporation from C. *h* is one of three hooks projecting from the side of A—these hooks are aids in levelling the instrument.

s is one of three screws for levelling. The screws and hooks are in the same radii.

F is a cylinder fixed in the ground, and has three bearers for receiving the levelling screws. D is the guard to prevent the approach of birds.

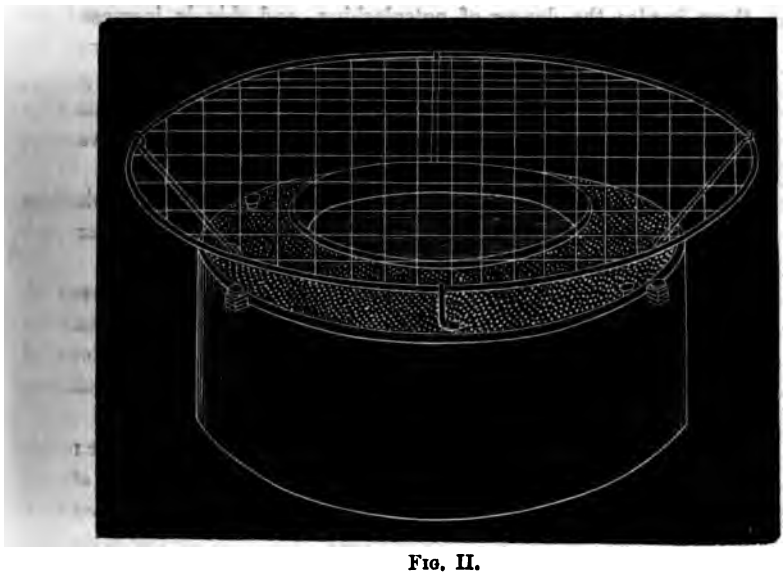


FIG. II.

Fig. II. gives a perspective view of the instrument as it appears when ready for use.

In fixing this apparatus it seems best to place cylinder F in position, and it is convenient to use the ground as a base (levelling the cylinder), and to bank up the earth around F. This being done, andthe valves *a* and *d* being closed, chamber B is filled with water and cap *b* screwed down. Water is poured into the open cylinder A up to the three hooks, the whole is carefully weighed (a record being made of the weight), and then placed in the fixed cylinder. The levelling is effected by means of the three screws, valve *a* is raised, and water flows out (as indicated by the arrow) till it is level with the top of the aperture, and there it remains.

As evaporation takes place, more water flows from B to A, valve *d* is also raised. If rain falls, it must rise in A 0·2 inch before it flows over into C, *i.e.* the curve of the overflow pipe *o* is 0·2 inch above the top of the level of the orifice at *a*. If this arrangement, then, works satisfactorily, C should retain the measure of the rainfall (minus 0·2 inch) in any given time.

The guard D is fixed after the valves are opened.

It will be seen that the dimensions of this apparatus are of only secondary importance, but it may be advisable to make it deeper than the one I have constructed as an experiment. Insplashing appeared to present a difficulty, as it always has done; and to obviate the danger of this I covered the top of the surrounding cylinder with perforated zinc. In order to test the efficacy of this, I used a large syringe to throw water upon it, and though I placed blotting paper in the open area I could detect very little, if any, spray.

This covering helps to prevent the undue heating of the apparatus by the sun's rays, and I may point out that the internal cylinder is kept cool through its being surrounded by the two compartments and the fixed cylinder banked with earth.

But there is also the danger of outsplashing, and this is increased by the necessity of keeping the level of the water as near to the rim as possible. Now, to obviate this, I propose to use a screen of wire-gauze, which will allow air to pass through it, but when moistened forms a thin film which prevents the passage of water when the screen is placed in a vertical position.

There is one point upon which I have not yet decided, viz. whether the gauze screen shall be a continuance of the eight-inch cylinder and surmounted by the brass rim, or whether it shall surround the rim.

In the "Report of the Proceedings of the Meteorological Congress at Vienna," pp. 54, 55, I find it is proposed to determine the evaporation by floating a small *atmometer* on a lake or pond, but no particular form of apparatus is recommended. I therefore propose to adapt the self-regulating atmometer to that purpose.*

For floating on a large surface of water, I would make the atmometer much deeper than this first one, fit it with a deeper screen, put a metal sheath packed with felt over the exposed part, and swing it on *gimbals* attached to a light wooden frame which would be raised above the level of the water, the whole to be carried by a large frame of wood of sufficient buoyancy. I think

* Before I proceed further, I wish to make a remark on the material of which evaporators are made. Zinc is mentioned in the Vienna Report, already referred to, as being used for some evaporating vessels. Now I have found zinc the most unsuitable of metals for that purpose. No covering of paint or varnish will prevent oxidation of the metal when water is kept in the vessels for any length of time. This material swells, soon becomes perforated, and easily bursts during frost. But I have used many zinc cylinders for fixing in the ground to hold rain gauges and evaporators. I often wonder that the opticians should send out their gauges without some means of fixing them. Why not adopt an open cylinder? When once the fixed cylinder is levelled, the rain gauge or atmometer can be lifted out or replaced without trouble or the need of further levelling; nevertheless I test the level after frost.

the rain must be allowed to fall into the floating atmometer, otherwise, while it is sheltered from the rain, it would be sheltered from the sun's rays also. There would be other and minor details, which need not demand attention here.

The readiest method of estimating the evaporation from the instrument I have described, is by weighing. For this purpose I use a delicately constructed machine kept with weights in a box near the atmometer. Of course measuring by a graduated glass jar can be adopted if an observer decides to do so. In that case he would measure the water put into the upper compartment and the open vessel, and on making an observation, would measure the water left in all the compartments. But I think weighing will commend itself to every one as preferable to any other method. If the rainfall since the last observation be ascertained, it takes only three or four minutes to determine the amount of evaporation. But to facilitate the work I constructed two Tables.

Table I. gives weight of water, with its equivalent depth in inches or decimals of an inch.

Table II. gives the depth in inches or decimals of an inch of water with its equivalent in weight.

The Tables are computed in the following manner:—

(a.) One inch of rain water, in an eight-inch circular gauge, weighs 12,680 grains; and 1 oz. of water $= \frac{7000}{16} = 437{\cdot}5$ grains.

Therefore $\frac{437{\cdot}5}{12680} = 0{\cdot}0345$ inch $= 1$ ounce.

(b) As 1 oz. of water is $= 0{\cdot}0345$ inch in depth, therefore, for 0·01 inch of rain water we have $\frac{{\cdot}01}{{\cdot}0345} = 0{\cdot}29$ oz.

TABLE I.

(Weight of water = depth in inches.)

¼ oz.	=	0·009 inch.
½ ,,	=	0·017 ,,
¾ ,,	=	0·026 ,,
1 ,,	=	0·034 ,,
2 ,,	=	0·069 ,,
3 ,,	=	0·103 ,,
4 ,,	=	0·138 ,,
5 ,,	=	0·172 ,,
6 ,,	=	0·207 ,,
7 ,,	=	0·241 ,,
8 ,,	=	0·276 ,,
9 ,,	=	0·310 ,,
10 ,,	=	0·345 ,,
11 ,,	=	0·389 ,,
12 ,,	=	0·415 ,,
13 ,,	=	0·448 ,,
14 ,,	=	0·483 ,,
15 ,,	=	0·517 ,,
1 lb.	=	0·552 ,,
2 lbs.	=	1·104 ,,

TABLE II.

(Depth of water = weight in ounces.)

0·005 inch	=	0·145 oz.	
0·01 ,,	=	0·29 ,,	
0·015 ,,	=	0·43 ,,	
0·02 ,,	=	0·58 ,,	
0·03 ,,	=	0·87 ,,	
0·04 ,,	=	1·16 ,,	
0·05 ,,	=	1·45 ,,	
0·06 ,,	=	1·74 ,,	
0·07 ,,	=	2·03 ,,	
0·08 ,,	=	2·32 ,,	
0·09 ,,	=	2·61 ,,	
0·10 ,,	=	2·90 ,,	
0·105 ,,	=	3·04 ,,	
0·20 ,,	=	5·80 ,,	
0·25 ,,	=	7·25 ,,	
0·30 ,,	=	8·70 ,,	
0·35 ,,	=	10·15 ,,	
0·40 ,,	=	11·60 ,,	
0·50 ,,	=	14·50 ,,	
0·60 ,,	=	17·40 oz.	= 1 lb. 1·4 oz.
0·70 ,,	=	20·30 oz.	= 1 lb. 4·3 oz.
0·75 ,,	=	21·75 oz.	= 1 lb. 5·75 oz.
1·00 ,,	=	29·00 oz.	= 1 lb. 13 oz.
2·00 ,,	=	58·00 oz.	= 3 lbs. 10 oz.

The following is an example of the method of estimating the amount of evaporation by the use of these Tables:

Taking the observations in September, 1875,—

			lb.	oz.
Atmometer set on September 1, weighing			20	0
Rainfall in September, 2·217 inches.				
		lb. oz.		
From Table II.	2·0 in.	= 8 10		
	0·2 in.	= 0 5·8		
	0·02 in.	= 0 0·58	4	0·88
		Total	24	0·88
Weight of Atmometer on October 1		=	21	5·5
Decrease of weight by evaporation		=	2	10·88

	lb.	oz.	Inches.
From Table I.	2	0	= 1·104
	0	10	= 0·345
(very nearly)	0	0.75	= 0·026

Evaporation in September = 1·475 inch.

It might be worth while to elaborate the Tables, in order still further to facilitate calculation.

The instrument above described has been in operation since May last. It was placed near a tank having a surface of water of 36 square feet, and holding about 500 gallons. The temperature of the water in these has been taken each morning at 9 a.m.

The following Table shows the result:—

AVERAGE TEMPERATURE AT 9 A.M.

(One Inch below surface.)

MONTH.	Temperature of Water.		Difference.	Greatest Difference of Temperature during the month.	Number of days on which they both agreed.
	In Tank.	In Atmometer.			
	°	°	°	°	
May	59·8	59·1	−0·7	−4·5	4
June	61·5	63·2	+1·7	+4·0	7
July	60·0	61·1	+1·1	−5·0	7
August	65·0	63·0	−2·0	−6·2	6
September	59·8	60·3	+0·5	−6·0	..
October	47·4	46·0	−1·4	−8·0	4

COMPARISON AS TO EVAPORATION BETWEEN THE TANK (*a*) AND ATMOMETER (*b*).

	Inches. (*a*.)	Inches. (*b*.)	Inches. (*a*—*b*.)
June	2·67	3·07	+0·40*
July	2·31	2·38	+0·07
August	2·56	2·43	—0·13
September	1·50	1·47	—0·03
October	0·57	0·62	+0·05

* There is a discrepancy in June for which I cannot account.

I think I may say that the practical working of the instrument has proved satisfactory.

A severe test as to the overflowing was given in July, when the rainfall was unusually heavy. The level was constantly maintained, while several other evaporators had to be relieved of their contents two or three times in that month.

The capacity of the present instrument is such, that 10 inches of rain must fall before any loss by overflow would take place; and more than 8½ inches must evaporate before the upper compartment would be emptied, and the level lost. During the past summer, this upper compartment has not been emptied by evaporation; but if it were found necessary to give a greater capacity to this feeding chamber, another inch in the diameter would meet the want, for the floor should not be lowered if it could be avoided. I say this in anticipation of its being left to do a whole month's work; but I think that any observer, who intended to work the subject thoroughly, would make more frequent observations, and if all the arrangements which I have suggested were adopted, a daily observation would be found practicable, and perfectly easy.

If the vessel were made deeper, and the top covered with felt, as I propose for the floating apparatus, most likely the temperature would be more nearly equal to that of the tank.

I have no apprehension of the bursting of the upper compartment during frost, because it never remains full after the instrument is set, for some water must run out to fill up the open vessel, between the hooks and the top of the aperture, and if the levelling screws be not disturbed, there will be no need to fill the centre up to the hooks; then more water than usual can be allowed to flow out. Besides, the feeding chamber does not require filling each month in winter, when the evaporation is small. I have made no close calculation on this point, but imagine that the supply will last from November to March.

A few modifications must be made in the details of the instrument, but these will not affect the general principle. Whether the screen is efficient or not, whether it shall be permanent or moveable, and what height it shall be, are points which require further consideration.

DISCUSSION.

Mr. SCOTT exhibited Prof. von Lamont's Atmometer, described in the 'Münchener Wochen-bericht,' No. 158, for the year 1868. It consists of a cylindrical

vessel, communicating by a fine pipe with a pan, the area of which has a definite ratio to the section of the cylinder. If water be poured into the pan till it is full, the level of the liquid will, of course, be the same in the cylinder as in the pan.

The cylinder is provided with a plunger, by which the water can be forced into the pan, and this plunger is fitted with a scale to show the depth to which it has been inserted into the cylinder.

The mode of reading is as follows: water is poured into the pan until its level just attains the entrance of the small connecting pipe at the bottom of the pan, when the scale of the plunger is at 0. The plunger is then screwed down, until the water in the pan rises to within about two millimetres of the edge, and the instrument is left alone. At the end of the period of observation, the plunger is screwed up till the level of the water in the pan sinks again to the entrance of the pipe, and the scale is read again. The difference between the readings gives the evaporation.

The diameter of the pan is 3·2 inches. It is clear that the apparatus must be sheltered from rain.

Mr. DINES said he could not but admire the very ingenious way by which Mr. Miller had contrived to make the rainfall, and the water which supplied the Atmometer, act as a jacket to the vessel from which the evaporation took place. He would, however, notice a few points which had struck him in connection with the paper. It was proposed that the instrument should be floated in water. If this could be done, one of the great difficulties connected with all evaporation gauges would be avoided—that of the unduly heating of the body of water from which the evaporation was measured. He noticed that the wire covering extended all over the instrument; he had tried this, but found it got hollow in the middle, and the rain drops trickled down the wires, and fell into the gauge where evaporation was to be measured, and this was of some consequence. He had, however, got over the difficulty by keeping the wire covering of the same diameter as the gauge. He could corroborate Mr. Miller as to the evaporation from ice; but it only occurred when the dew point was below 32°. If a piece of ice were now brought into the room, there would be no evaporation, but a considerable amount of condensation upon its surface.

He next noticed that the water in Mr. Miller's gauge was kept about 3 inches* below the edge of the vessel. This he considered a most serious defect, as the evaporation would be one-third less than it would be if the vessel were kept full. This was not a mere matter of opinion, as it would be found in his paper on evaporation (Proceedings of the Meteorological Society, Vol. V., page 210) that he had made experiments with vessels of the same diameter as Mr. Miller's, and that when the water was kept two inches below the edge, the evaporation was 18 per cent. less, and at three inches below it was 35 per cent. less, than when the vessel was kept full. It was proposed that the amount of evaporation should be determined by weight. This plan was adopted by Dr. Dalton, and as Mr. Symons was aware, he (Mr. Dines) had used the same method in his earlier experiments. He had, however, found it a troublesome process. It might be tolerated once a month, but if done every day, some other method would be sought for. He denied that there was any difficulty in determining the amount of evaporation by measure, for he had taken it nearly every day and night during the present year, by the instrument described in his paper, which was so sensitive that, on alternately dipping a thin rule into the water and then withdrawing it, the oscillation of the float could be plainly seen. The rule used was so thin that it only raised the surface of the water the 1-1200th part of an inch, and would therefore require four decimal places of figures to show the difference. He next noticed some of the difficulties common to all evaporation gauges; the first was, the heating of the film of water at the surface by the sun's rays *when the water was in a quiescent state*, which was much greater than in the case of a body of water agitated by the wind and waves. In his opinion, this was the greatest difficulty of all; and at present he saw no means of avoiding it. Another difficulty was that, on very wet days the evaporation appeared to be greater than on other days. Again, take a day like last Sunday (Nov. 14th), what with the wind, the rain, and falling leaves, it seemed almost impossible to measure the evaporation correctly; but on that day his gauge did not appear to be much out. He could not, at present, place much

* The exact depth was 2½ inches.

dependence upon the results obtained in wet weather. If it should be agreed to place the evaporation gauge under cover, as had been done with thermometers, nine-tenths of the difficulties he had named would be met; and he could not help thinking that the temperature of water placed under an open shed, would more nearly represent that of the sea than if it were placed in the open air and exposed to the sun's rays. He then referred to some tables he had lately made. It was a common opinion that no evaporation took place at night; this was a great mistake, for during the month of September last, he made the evaporation to be 2·28 inches; of this 65½ per cent. occurred in the day, 34½ per cent. at night. In March last it was 1·15 inches, of which 59 per cent. was in the day, and 41 per cent. at night. In April the total was 2·20 inches, of which 64½ per cent. took place by day, 35½ per cent. at night. These results, it must be remembered, were obtained from a small body of water, which was unduly heated by day, and so increased the evaporation; while the contrary was the case at night. He had, therefore, little doubt that, from a rough sea, with but little change of temperature in the 24 hours, the evaporation was as great between 12 and 1 at night as it was between 12 and 1 in the day.

On the 1st September last, the evaporation during the day was ·059 inch, but at night only ·005 inch. This was accounted for by a sudden change of temperature from cold to warm, which at once checked the evaporation. Again, on September 17th, with a shade temperature of 80°, the evaporation was only ·002 inch in the day. This was in what may be called "thunder weather," close and oppressive, during which little or no evaporation takes place. There were other anomalies in the table which he could not so easily account for. When he first commenced the study of this question, it was with the view of determining the monthly evaporation; he now looked upon that as a matter of secondary importance. It was the circumstances he had pointed out, and the constant changes he had found to occur, which, in his opinion, constituted the great charm of the subject; and it was there he would recommend meteorologists to study.

Whatever instruments might be devised, the evaporation from the small amount of water placed in them would never fairly represent that which took place from the sea,—the circumstances were so essentially different; they must be content to know that it somewhat exceeded the rainfall in amount. He thought the evaporation from the sea, when tossed about by wind and wave, was something beyond what they had any conception of; and he roughly estimated that a cold dry wind, passing over the Gulf Stream, would produce an evaporation of from 1 to 1½ inches, or it might even amount to 2 inches, in the 24 hours.

Mr. SYMONS rejoiced to see Mr. Dines present, as he had done as much as, if not more than, any one in evaporation, but regretted the absence of Mr. Field, who also had had much to do with the same subject. He thought that the instrument exhibited was the best form of small evaporator at present constructed; it was the result of many years' careful observation on the part of Mr. Miller. He could not comprehend how it was that there was no insplashing when the external cylinder, covered with perforated zinc, was syringed with water; but he took Mr. Miller's word for it that such was the case. He would abolish the tables, and weigh the apparatus by a steel-yard dividing it to show the amount of evaporation in inches instead of the weight in pounds and ounces. He did not like the screen used on the evaporator, as he thought there was little danger of birds going there, and a screen so near the water surface would unduly interfere with the effect of wind upon the amount evaporated. He was surprised at the agreement of the temperature of the water in the atmometer with that in the tank but was sorry that Mr. Miller had not taken any mid-day readings.

Mr. MILLER said he did not think that in this latitude the evaporation from the sea was so great as Mr. Dines had stated. Some reference was made a short time ago, in the *Meteorological Magazine*, to the evaporation from sea-water. He had, conseqnently, taken observations from salt water, and found that the salt retarded evaporation. It had been said that an evaporator under the shade would not do, as it did not represent the evaporation which takes place from ponds, lakes, large rivers and at sea. His object in devising this instrument was to obtain an atmometer which could be exposed to all kinds of weather without derangement. He had frequently found that there was more

evaporation during rain than in dry weather. He had been at work at evaporation now for many years, and had about 18 evaporators in constant use, some of which were read daily. He would mention that he had used the steel-yard for some of them.

IV. *On the Registration of Sunshine.* By Robert H Scott, F.R.S.

[Received November 6th.—Read December 15th, 1875.]

It may be within the knowledge of some of the Fellows, that in the Seventh Report of the Society, that for 1857,* there will be found a paper by Mr. J. F. Campbell, F.G.S., of Islay, describing a Registering Sundial, consisting of a hollow glass globe filled with water, such as is used by engravers. This is placed in a hemispherical bowl of wood of such a diameter that the distance of the inner surface of the bowl from the globe is equal to the focal length of the latter. When the sun shines on the globe its rays are concentrated on the wood, which is charred, and a groove is burnt out corresponding to the duration of sunshine on the day on which the instrument is exposed.

This apparatus was erected on the roof of the house occupied by the General Board of Health in 1854, and kept there for twenty years, under the management of Mr. J. C. Haile for a considerable portion of the time. At the expiration of the third year, the hollow globe was exchanged for a solid sphere of glass.

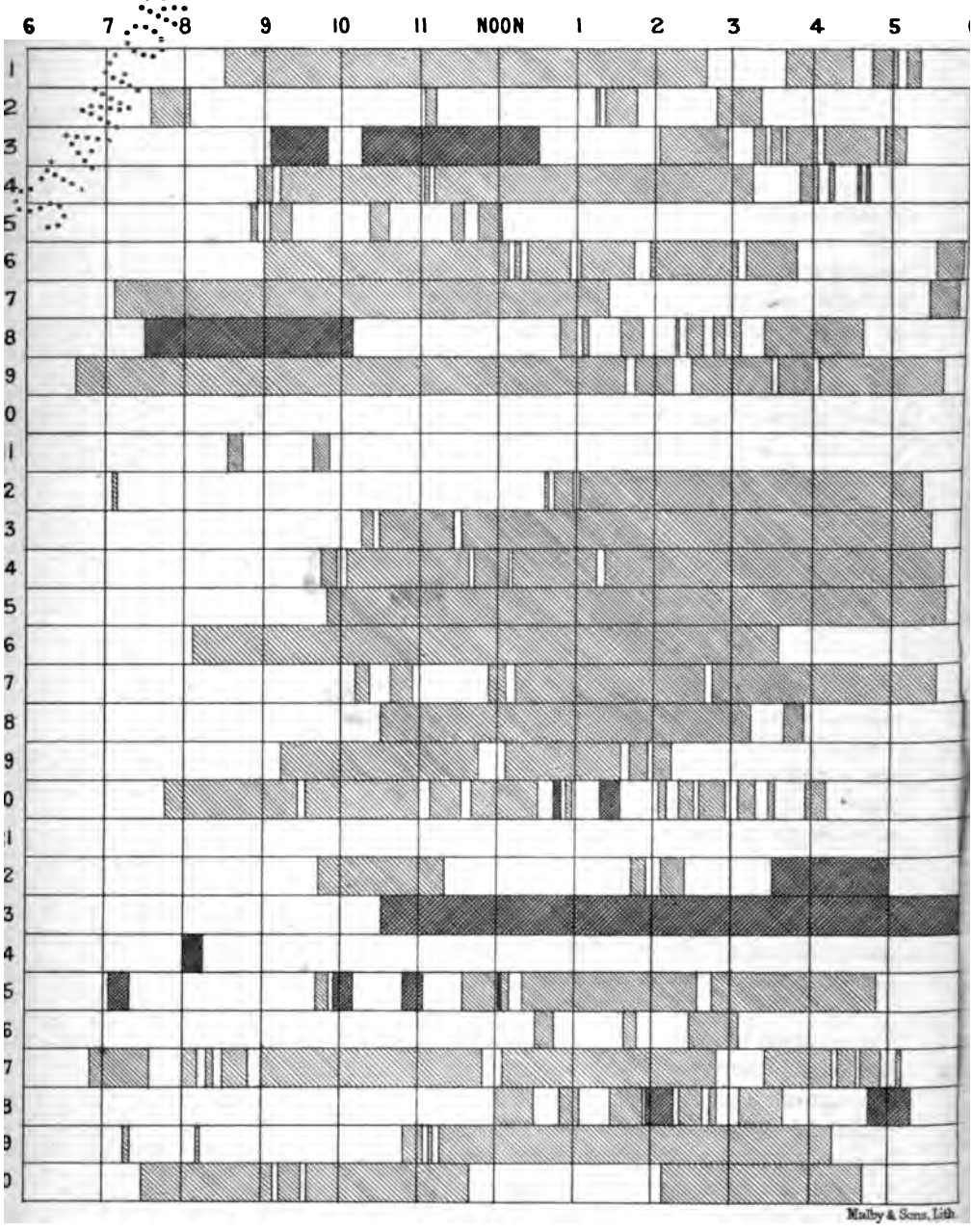
A notice of the method, with a representation of the effects of solar heat on two of the charred bowls, is contained in the 'Report on the Warming and Ventilation of Buildings,' printed by order of the House of Commons, 1857, p. 151.

In the year 1873, the entire series of these bowls was transferred to the Meteorological Office, and the question then came before me as to how this plan could be rendered workable, so as to afford a daily record of the duration of time for which the heat of the sun had power enough to burn a hole in wood or paper. It is obvious that the plan of hollow wooden bowls is not suitable for such a purpose, inasmuch as the track of the sun for each day overlaps that for the preceding day, and the result is, at best, merely a rude representation of the general effect of the sun's heat during the interval between the successive solstices; for the bowl was only changed twice a year. The amount of wood destroyed must, of course, depend, to a certain extent, on the grain and density of the special block out of which each individual bowl is made.

It is next to impossible to reduce these results to absolute measure, and the only systematic attempt to do so is described in the 'Proceedings of the Royal Society,' No. 163, p. 578, in a paper by Professors Roscoe and B. Stewart, to whom I had handed over the entire series of bowls. Their measurement was effected by filling up the excavated portions of each bowl with a mixture of beeswax and olive oil, and then smoothing the surface of

* Report of the Council of the British Meteorological Society, 1857, p. 18.

SUNSHINE AND RAIN AT KEW,
DURING
SEPTEMBER, 1875.



Signifies Sunshine. *Signifies Rain.*

this material so as to correspond with the original curvature of the bowl. The bowl was then weighed, when filled up and when empty, and the experiment was repeated twice. By these means the authors of the paper have arrived at certain figures, which tend to confirm the idea "that there is more solar heat in London in years of maximum than in years of minimum disturbance."

The apparatus is now erected at Kew, where it will continue to work; and I submit to the Society the bowl for the half year ending June 21st, 1875.

I shall now proceed to describe what I have done in the way of obtaining a more manageable record. In the original paper Mr. Campbell describes two methods of obtaining this end. The first is to make the bowl of stone, and to smear it with coal-tar, or black varnish. The sun's heat melts this coating along the track traversed by its image, day by day, and the method of recording is to rule paper with hour lines, and to mark off on it the periods for which the varnish has been melted. This is done at sunset, and the bowl is then prepared for next day's use by smearing it afresh.

The second method is to affix a ribbon or tape to the inside of the bowl so as to catch the sun's image, and to change this daily. The difficulties met with in this process are those of fixing the ribbon in its place in a satisfactory manner, and of providing a suitable cement.

It is this latter process which I have followed; and, with the assistance, firstly, of Mr. Lecky, one of our Fellows, and, secondly, of Mr. S. Jeffery, at Kew, I have succeeded in obtaining a daily register for some months, which, at least, proves that it is possible to obtain a record which will admit of being tabulated. It is, of course, no measure of the intensity of *insolation*, but, such as it is, it seems likely that some use may be made of the process which, with all its defects, is the simplest hitherto introduced for registering the duration of sunshine.

The principle of the instrument is that the strip of paper is held in clips along the inner surface of a ring which is concentric with the spherical lens, and whose radius is equal to the radius of the lens + its focal length. This ring is attached to a vertical circle, along which it is moved to correspond with the varying declination of the sun.

The material employed for the record is thin millboard.

It is obvious that a time scale could be printed on the millboard.

Plate I. shows the results obtained by this method for the month of September last, together with the duration of rainfall, as registered by Beckley's Rain-gauge, for the same period.

DISCUSSION.

CAPT. TOYNBEE asked whether there was any record of intensity by this method?

Dr. TRIPE, in answer to a question by the PRESIDENT, said he was not aware of any comparisons which had been made between the duration and intensity of sunshine and the prevalence of epidemic, or other diseases, unless it be admitted that an unusual length of sunshine and a high temperature are actually coexistent. In that case, he would observe that it is well known that deaths

during unusually cold periods are in excess in this country from old age and bronchial affections, as well as from most others, excepting epidemic disease; that whilst deaths from diarrhœa are much more numerous in hot weather, it is by no means certain that the excess of deaths is caused directly by the heat; on the contrary, the evidence rather shows that they arise from the partially decomposed food which children then take, such as sour milk; and from putrefactive action in the excremental and other similar substances by which we are more or less surrounded. As regards scarlatina, the number of deaths is smallest about the 14th or 15th week of the year, and increases up to the first or second week in November, when the mists and fogs, and consequent absence of sunshine, are most common. He thought that records of sunshine kept in the manner shown that evening will be most useful, but will be of comparatively little use for 15 or 20 years, as we are almost certain to fall into error if we work upon a few years' results. He had found it worse than useless to compare the effects of temperature with death rates in different years, without making corrections for increase of population, so that any one who shall hereafter use for this purpose the admirable meteorological returns which are being made by Fellows of this Society, should bear this in mind.

THE PRESIDENT pointed out that it was extremes of temperature, rather than excess or deficiency of sunshine, that produced evil effects upon the public health. In lands like South-Eastern Africa, high inland regions, with intensely hot sunshine, were more healthy than low-lying coast districts, where the sun shone with less continuance and force.

Mr. SYMONS had assisted Mr. Haile with this kind of instrument many years ago. They had found that sunshine was more prevalent in the afternoon than in the morning. Mr. Campbell gave as an explanation, that this was caused by the smoke in London; but the diagram exhibited showed the maximum to be about 2 p.m., and the same deficiency in the morning hours. He thought that at Kew this could not be caused by smoke. The wooden cups were objectionable, as they got damp, and thus prevented the burning of the wood. Mr. Crallan had made a comparison of the duration of sunshine with relapses in the patients at the Lunatic Asylum at Hayward's Heath, and found that they varied with the maximum of solar radiation. He thought that a comparison ought to be made of the duration of sunshine and the number of deaths from diarrhœa in London and the country; for the sun's rays cannot penetrate the London atmosphere so well as that of the country, as is evident from the Londoners' complexions.

Mr. BICKNELL thought it very desirable that any observation for the purpose of showing the influence of sunshine upon health, should be accompanied by observations of the direction of the wind, as the death rate is considerably increased by E winds, which often occur with clear skies.

Mr. CATOR wished to know if Mr. Scott had observed any connection between the amount of evaporation and that of sunshine; and, if evaporation was directly influenced by sunshine, to what extent?

Mr. WHIPPLE said that there was more certainty with this instrument than with Roscoe's, as it does not require any attention, while the latter requires to be constantly looked after, and only gives a record of two minutes at every hour. As colour has a great influence on the burning, it is desirable to have a number of instruments with different coloured slips. The numerous breaks in the records shown in the diagram for the morning hours were doubtless due to the mist, which is prevalent at Kew, preventing the registry of the sunshine. He believed that no advantage would be derived from putting more slips underneath, on account of the short focal length of the glass sphere.

Mr. LAUGHTON said that mere change of temperature did, sometimes at least seem to have a direct influence on health, in a way quite independent of diet. One common enough instance of this was the number of deaths that occurred, between the tropic and the Cape of Good Hope, on board ships bringing home invalids from China during the southern winter.

Mr. SCOTT stated that the present paper was merely intended to draw the attention of the Society to the subject. The arrangements were hardly scientifically exact enough. The globe was not a true sphere, and the glass of which it was made was full of defects. A perfect sphere of good glass would be very costly. The instrument only registered the duration of sunshine, and not the intensity of the heat; but he believed that Dr. Stewart had, in a recent No. of

'Nature,' announced an instrument which would measure the latter element. With reference to the relation of the duration of sunshine to the state of public health, it would be remembered that Mr. Campbell, in his original paper before the Society, had touched on that subject. In reply to Mr. Cator, he said that he had not taken up the question of evaporation.

Mr. SYMONS said, that with reference to the records of the duration of sunshine in Scotland, published by the Scottish Meteorological Society, the number of hours were simply estimated; for whilst visiting one of their observers, he found that there was always a discussion in the family circle in the evening, before going to bed, as to the duration of the sunshine during the day.

V. *On the Rainfall at Calcutta.* By R. STRACHAN, F.M.S.

[Received November 11th.—Read December 15th, 1875.]

THE observations used in this investigation were made at the Office of the Surveyor-General at Calcutta, and are printed in his Monthly Reports of the Meteorological Observations made under his direction. The position is in latitude 22° 33′ 1″ N., longitude 88° 20′ 34″ E., and elevation above the sea 18 feet.

The Tables accompanying this paper have been drawn up in the following manner:—

Having collected all the observations for, say June 1st of each of the years 1847 to 1874, I have added together the amounts of each day's rain, and counted the number of days on which rain fell, and noted the maximum fall and the year in which it happened. Thus on the twenty-eight 1sts of June, 5·41 inches of rain fell on 10, so that it is to be inferred that no rain fell on the other 18, and the largest amount, 1·14 inches, was observed June 1st, 1870. The monthly means of rainfall are given at the foot of each Table, and have been calculated from the observations of the entire 28 years. The monthly means of days of rain have been computed from the same number of years' observations as the daily sums of rainfall; thus, for July it will be seen to be from 27 years', for October from 24 years', observations. The cause of this has been that I have not been able to get the *daily* observations for a few months, though I have been able to get the corresponding *monthly* amounts.

These Tables will serve for estimating the probability of rain on any day and its mean amount, and afford an indication also of the extreme amount. Thus, for July 1st, the chance of rain is 18 in 27, and its mean amount 1 inch nearly, extreme amount above 8 inches; whereas, for January 1st no rain has been recorded in the 28 years.

The greatest fall on any one day was 12·09 inches on June 13th, 1861; the next in magnitude was 10·99 inches on June 9th, 1869; October 22nd, 1851, claims the next in extent, 10·12 inches. During the 28 years, falls exceeding 8 inches in 24 hours have occurred in March 1, April 1, May 4 times, June 14, July 8, August 12, September 9, October 8, November 1. The most rain falls in July, but the heaviest downfalls are most frequent in June, and heavy downfalls are more frequent in August than in July. The greatest number of days of rainfall is in July, but the number is almost the same for August.

TABLES OF DAYS OF RAINFALL, with sums of amounts on the same day of the month during 28 years, 1847 to 1874, with day's maximum amount, at Calcutta.

	JANUARY.				FEBRUARY.				MARCH.				APRIL.			
	Sums.	Days.	Max.	Year.	Sums.	Days.*	Max.	Year.	Sums.	Days.*	Max.	Year.	Sums.	Days.	Max.	Year.
	In.		In.		In.		In.		In.		In.		In.		In.	
1	—	—	—	—	1·33	3	·80	1874	·87	2	·65	1871	·27	2	·14	1855
2	·07	1	—	1851	·48	3	·23	1849	7·63	4	3·83	,,	1·30	2	·99	1848
3	—	—	—	—	·09	1	—	1860	·79	1	—	,,	2·14	3	1·84	1871
4	—	—	—	—	1·61	2	1·28	1849	2·35	4	1·80	1859	3·02	5	·94	1854
5	—	—	—	—	2·01	1	—	1874	2·05	2	1·08	1865	1·48	4	·87	1868
6	—	—	—	—	1·48	3	·74	1855	1·96	4	1·19	1869	1·06	3	·90	1860
7	—	—	—	—	1·02	3	·78	1872	1·06	4	·41	1874	1·13	1	—	1857
8	1·16	3	·48	1867	·11	1	—	1851	2·14	4	1·06	1873	·85	3	·58	1863
9	—	—	—	—	2·03	2	1·93	1869	·53	3	·27	1848	1·27	1	—	1870
10	·56	1	—	1861	1·43	3	·72	1865	1·60	6	1·04	1869	1·82	4	·97	1859
11	—	—	—	—	5·02	6	2·06	1851	·89	3	·52	1857	·05	1	—	1867
12	—	—	—	—	1·60	2	1·26	1866	·03	1	—	1870	1·76	3	·70	1868
13	—	—	—	—	·68	2	·41	1854	·35	2	·26	1852	·48	3	·20	1853
14	·80	1	—	1852	·91	3	·63	1874	·62	2	·46	,,	·87	2	·70	1847
15	—	—	—	—	·40	1	—	1872	·43	2	·41	1856	4·96	5	4·13	1854
16	·36	1	—	1862	·40	2	·24	1863	·92	2	·52	,,	2·97	4	1·44	,,
17	2·64	2	2·44	1849	·63	2	·38	1864	1·17	4	·74	1852	2·14	5	1·02	1860
18	·02	1	—	1870	—	—	—	—	·14	1	—	,,	1·57	5	·64	1851
19	—	—	—	—	·47	2	·37	1855	·86	3	·47	1856	2·08	3	1·10	,,
20	·60	2	·48	1870	1·49	2	1·37	1872	3·01	5	1·16	1849	2·26	4	1·02	1873
21	·32	2	·25	,,	—	—	—	—	·27	2	·21	,,	2·48	7	1·06	1851
22	·02	1	—	,,	—	—	—	—	2·46	2	2·32	1869	3·70	9	1·67	1865
23	·58	1	—	1852	·12	1	—	1867	·33	3	·14	1854	1·63	4	1·36	,,
24	·08	1	—	,,	1·33	4	·66	1859	3·03	4	1·22	1864	·96	5	·28	1872
25	·50	2	·49	1874	—	—	—	—	1·39	2	1·25	1852	3·06	6	1·46	1871
26	·53	2	·47	1862	1·00	3	·66	1865	·47	1	—	,,	3·48	8	1·06	1850
27	·26	2	·16	1865	·18	1	—	,,	·22	2	·15	1867	1·69	3	·84	1870
28	1·23	2	·78	1869	—	—	—	—	—	—	—	—	2·34	5	1·16	1866
29	·80	1	—	1866	(2·00	total,	1850.)	—	1·65	2	1·58	1862	2·99	5	1·16	1852
30	·54	3	·22	1874	—	—	—	—	·22	1	—	1854	2·62	4	·81	1874
31	2·12	5	1·06	1856	—	—	—	—	·79	1	—	,,	—	—	—	—
									(1·52	total,	1850.)					
Monthly mean	0·47	1·2	2·44	1849	0·99	2·0	2·06	1851	1·49	3·0	3·83	1871	2·09	4·3	4·13	1854

* For February and March the days and sums are from 27 years' observations.

TABLES OF DAYS OF RAINFALL—*continued.*

	MAY.				JUNE.				JULY.				AUGUST.			
	Sums.	Days.	Max.	Year.	Sums.	Days.	Max.	Year.	Sums.	Days.*	Max.	Year.	Sums.	Days.	Max.	Year.
	In.		In.		In.		In.		In.		In.		In.		In.	
1	3·48	4	1·56	1852	5·41	10	1·14	1870	17·98	18	3·13	1864	22·81	23	6·63	1859
2	2·61	4	1·84	1858	10·05	15	3·87	1871	13·81	18	4·20	1866	12·61	20	5·04	1850
3	4·92	8	·86	1860	11·38	15	3 66	1854	17·36	18	3·98	1867	10·83	22	1·90	1865
4	3·98	6	1·36	1859	9·44	9	3·32	,,	8·38	16	2·20	1857	9·56	14	2·10	1857
5	2·67	5	·96	1862	11·39	10	3·50	1861	8·49	15	2·38	1858	8·80	17	1·43	1874
6	4·62	8	1·26	,,	4·82	11	1·60	1859	4·63	11	1·42	1855	15·36	19	3·32	1850
7	6·07	6	2·38	1857	11·07	14	5·35	1868	8·23	16	1·60	1862	7·71	19	1·08	1861
8	3·61	8	1·56	1868	7·39	13	2·42	1869	12·96	16	2·24	1852	8·94	14	2·10	1864
9	4·15	8	1·42	1857	20·46	15	10·99	,,	7·26	13	2·30	1849	13·82	24	2·26	,,
10	4·92	10	1·65	1865	9·67	15	1·47	1874	16·74	16	3·47	1868	7·39	14	1·24	1850
11	3·88	10	·97	,,	8·07	10	2·16	1864	8·14	17	2·10	,,	12·42	18	3·06	1868
12	3·33	7	·98	,,	10·04	15	2·18	1871	7·41	16	1·22	1865	19·41	21	8·19	,,
13	3·08	5	1·40	1871	28·12	18	12 09	1861	10·70	16	2·89	1869	8 88	17	2·01	,,
14	12·93	5	8·40	1852	15·61	14	3·45	1868	15·60	17	2·96	1852	19·10	18	5·50	1853
15	2·42	4	·89	1871	10·02	18	2·30	1847	9·16	23	1·60	1860	21·15	19	4·64	1867
16	3·29	7	2·09	1869	7·18	18	1·28	1865	7·46	19	1·34	1869	13·09	17	2·66	,,
17	7·57	8	2·60	1864	14·30	17	4·39	1870	10·73	19	1·38	,,	14·86	21	2·74	1847
18	2·26	7	·72	,,	13·27	16	2·62	1865	13·16	18	2·00	1852	15·06	20	2·30	1855
19	4·17	6	1·55	1863	16·71	18	4·36	1862	10·50	19	2·66	,,	7·65	19	1·84	1851
20	4·65	10	1·19	1848	17·59	17	4·07	1848	9·43	17	1·74	1849	9·71	16	1·63	1857
21	2·11	8	1·02	1847	6·88	13	1·07	1863	10·99	21	1·77	1869	13·82	15	2·78	1864
22	7·83	13	2·77	1865	10·64	15	3·19	,,	14·27	19	2·35	1858	11·48	16	3·50	1863
23	0·05	1	—	1869	8·32	16	2·41	1866	15·60	24	3·04	,,	12·33	18	3·74	1857
24	5·42	8	1·50	1865	14·83	18	2·86	1870	6·98	17	1 61	,,	9·70	13	3·40	1867
25	8·27	10	2·56	1871	8·15	15	1·68	1862	12·44	17	3·25	1871	9·69	17	3·16	1858
26	3·74	9	1·14	1849	8·90	14	2·34	1856	17·83	25	2·02	1859	5·91	18	1·76	1860
27	3·05	5	1·02	1865	11·31	20	1·69	1857	16·26	22	2·20	1848	8·61	17	1·26	1858
28	7·19	5	3·70	1855	10·76	18	3·08	1849	13·44	16	3·26	1873	4·73	13	·79	1865
29	8·92	10	4·58	1861	11·34	18	1 92	1864	7·11	15	1·68	1867	13·12	20	3·14	1866
30	5·29	10	3·10	1864	14·35	16	7·06	,,	8·59	19	1·20	1847	5·10	16	·82	1854
31	4·48	10	1·26	1856	—	—	—	—	22·16	16	6·63	1859	4·92	15	·98	1872
									(15·34	total	for	1850)				
Monthly mean	5·18	8·0	8·40	1852	12·41	12·5	12·09	1861	13·54	20·3	6·63	1859	12·81	19·6	8·19	1868

* For July the days and sums are from 27 years' observations.

TABLES OF DAYS OF RAINFALL—*continued.*

	SEPTEMBER.				OCTOBER.				NOVEMBER.				DECEMBER.			
	Sums.	Days.	Max.	Year.	Sums.	Days.*	Max.	Year.	Sums.	Days.	Max.	Year.	Sums.	Days.	Max.	Year.
	In.		In.		In.		In.		In.		In.		In.		In.	
1	5·35	15	2·15	1861	3·48	11	·81	1867	1·12	1	—	1867	·10	11	—	1858
2	10·84	17	3·08	1866	4·50	9	2·13	1856	2·74	1	—	,,	·28	1	—	,,
3	6·18	16	1·34	1857	7·06	11	2·05	1873	·04	2	·03	1870	·73	2	·70	,,
4	19·20	18	3·25	1871	8·57	9	3·83	1862	1·61	4	1·22	,,	·06	1	—	1872
5	10·83	17	2·20	1848	10·56	10	3·64	1861	·70	2	·41	,,	—	—	—	—
6	9·06	18	2·32	1873	3·07	8	1·03	1862	—	—	—	—	—	—	—	—
7	6·49	14	2·30	1856	5·48	11	2·00	1856	4·94	2	4·66	1847	—	—	—	—
8	18·41	18	4·29	1855	4·37	6	1·59	1864	1·86	4	·93	,,	—	—	—	—
9	19·26	16	3·84	1866	7·35	10	1·90	1872	1·74	2	1·31	1861	·60	2	·34	1849
10	9·48	14	1·81	1874	8·02	11	1·84	1857	4·23	4	2·13	1864	·62	2	·38	,,
11	12·87	19	2·08	1851	3·01	7	·89	1871	2·71	4	1·04	1863	1·09	2	·82	1873
12	10·81	17	2·29	1852	2·99	7	1·12	1862	·94	2	·59	1850	—	—	—	—
13	14·56	15	2·36	1865	1·03	6	·49	1856	·22	1	—	1863	·05	1	—	1847
14	7·98	17	2·05	1867	1·26	3	·53	1851	—	—	—	—	—	—	—	—
15	16·20	13	1·09	1847	2·58	3	1·27	1874	·60	2	·40	1861	—	—	—	—
16	17·11	13	2·52	1866	5·64	2	4·56	,,	·19	1	—	,,	·26	1	··	1861
17	15·32	16	1·28	1847	·92	3	·46	1869	—	—	—	—	—	—	··	—
18	16·31	18	4·15	1855	4·63	6	2·42	1853	—	—	—	—	—	—	·	—
19	17·04	10	3·98	1852	2·56	2	2·43	1867	—	—	—	—	—	—	·	—
20	9·64	15	1·96	1859	3·46	4	2·06	,,	—	—	—	—	—	—	—	—
21	10·33	15	2·34	1864	2·29	5	·77	1866	—	—	—	—	—	—	—	—
22	15·59	14	4·97	,,	12·85	6	10·12	1851	—	—	—	—	—	—	—	—
23	12·09	12	3·19	1849	5·81	8	3·76	1862	—	—	—	—	—	—	—	—
24	8·10	15	2·00	1847	9·26	6	2·58	1871	—	—	—	—	—	—	—	—
25	7·60	15	1·93	1868	13·99	9	3·92	1858	—	—	—	—	—	—	—	—
26	9·02	12	3·24	1862	5·16	3	3·93	,,	—	—	—	—	—	—	—	—
27	6·02	12	1·85	1853	2·27	2	1·39	1874	—	—	—	—	·20	1	—	1862
28	5·20	12	1·46	1860	4·30	4	2·56	,,	·04	1	—	1873	—	—	—	—
29	3·88	13	·79	1861	·55	2	·43	,,	·09	1	—	,,	—	—	—	—
30	11·99	11	2·68	1874	.92	2	·82	1849	·02	1	—	1872	—	—	—	—
31	—	—	—	—	2·56	3	2·31	1867	—	—	—	—	·16	1	—	1848
					5·86	total	for	1847								
					5·41	,,	,,	1848								
					3·61	,,	,,	1850								
					—	wanting for		1865								
Monthly mean	11·53	16·3	4·97	1864	6·13	7·6	10·12	1851	0·85	1·3	4·66	1847	0·15	0·5	0·82	1873

* For October the daily sums are from 24 years' observations, and the monthly mean amount from 27 years' observations.

December has the least frequency and amount of rain. Thus, there are just six months between the driest and wettest months. December has also the least tendency to heavy daily rainfalls.

The following tabulation of mean monthly rainfall, pressure, and resultant winds, shows two well defined seasons each of six months' duration, the wet season and the dry season. The mean pressure and the resultant winds are copied from Blanford's *Winds of Northern India* (*Phil. Trans.* 1874).

Months.	Mean Rainfall. Amount. Inches.	Days.	Mean Pressure At Sea-level. Inches.	Resultant Wind. Direction. °	Percentage.
January	0·47	1·2	30·040	N 38 W	40
February	0·99	2·0	29·964	S 79 W	23
March	1·49	3·0	29·888	S 33 W	47
April	2·09	4·3	29·792	S 3 W	74
May	5·18	8·0	29·685	S 12 E	65
June	12·41	12·5	29·570	S 5 E	58
July	13·54	20·3	29·569	S 12 E	65
August	12·81	19·6	29·629	S 18 E	55
September	11·53	16·3	29·697	S 30 E	40
October	6·13	7·6	29·859	N 53 W	13
November	0·85	1·3	30·001	N 19 W	58
December	0·15	0·5	30·061	N 27 W	60
No. of Years	28	28	5	10	10

The dry season includes November to April, during which on an average 6·04 inches of rain fall on 12 days out of 181, or on 1 out of 15 days. The wet season is from May to October inclusive, during which 61·60 inches of rain fall on 84 days out of 184 in the season, or about 1 in 2 days. Hence, there is ten times as much rain in the wet season as in the dry, and seven times as many rainy days. Nevertheless, falls exceeding 4 inches in the 24 hours have occurred in the dry season.

The mean annual rainfall is 67·64 inches, on 96 days.

It will be seen from the above tabulation that December has the maximum pressure, the greatest frequency of NNW winds, and the least rain. On the contrary, July has the minimum pressure, the greatest frequency of S b E winds, and the most rain.

Although from December to April the winds back from NNW to W and S, it appears that they must get to the east of South to bring the rains, and that they prevail for some time before the rains fairly set in, since in May they are as frequent from S b E as in July, although the rain of May is not half that of July. From September to October the wind rapidly veers from SSE to NW, but the remnants of the S b E wind evidently bring in rain to the last.

DISCUSSION.

GENERAL STRACHEY exhibited a Chart showing the approximate average rainfall in Northern India, enlarged from that given in Mr. H. Blanford's paper on the Winds of Northern India, lately published in the "Philosophical

Transactions." He observed that such averages as the author of the paper had calculated no doubt had a certain value for various purposes, but they hardly indicated any exact physical conditions, because the total rainfall of the year was made up of the quantities that fell at different seasons, under the action of very different causes. The chief fall was in the summer months or rainy season. There was a very distinct season of winter rainfall in Northern India, which only just reached Calcutta, and was not felt in the Peninsula. So, too, the rain of the spring months was in a great measure due to the sporadic storms commonly called 'North-Westers' in India. The true rainy season came in with the South-West Monsoon, which blew over the north of the Bay of Bengal as a south-easterly wind. Certain peculiarities of the distribution of the rainfall over the area shown in the map were pointed out, and it was shown how the fluctuations of the boundaries of the various zones of rainfall led, in years of scanty rain, to invasions of the region of no rain, which is normal along the Indus, into the area where the rainfall is commonly sufficient for the requirements of agriculture, and that this gave rise to the periodical Indian famines of North-West India. A somewhat similar extension of an area of relatively small rainfall that occupied the middle valley of the Ganges had apparently been the proximate cause of the late famine in North-Western Bengal.

Mr. SYMONS asked if the observations at Cherraponjee, where the fall was reported to be 600 inches, were continued, as this was considered to be the wettest place in the world.

GENERAL STRACHEY said that they were still continued.

The PRESIDENT said that the two distinct and altogether different causes of rainfall in Northern India, referred to by General Strachey, were very interesting to him on account of the analogous facts of a double cause of rainfall, namely, the Sea-Gale, and the Hill Thunder-Storm, which he had himself observed in Natal.

Mr. J. P. H. WALKER could scarcely agree with General Strachey that a hilly conformation of country at the mouth of the river Indus (had such physical character existed) would have rendered the Punjab a complete desert. Orissa, a part of India with which he had been many years acquainted, had an average rainfall of about 55 inches per annum. The bulk of this rainfall was derived from the South-West Monsoon, which, before reaching the basin of the river Mahamiddy, had to traverse nearly the whole continent of Hindostan, crossing in its path not only the western ghats, but a country presenting an almost continuous barrier of hills—of moderate elevation, it is true—but covering an area as extensive as that intervening between the mouth of the Indus and the centre of the Punjab.

VI. *Notes on the use of the Rotatory Thermometer, 'Thermomètre fronde,' on board Ship.* By ROBERT H. SCOTT, F.R.S.

[Received November 15th.—Read December 15th, 1875.]

IT is hardly necessary to allude to the difficulty of obtaining a satisfactory exposure for thermometers in a paper to be submitted to a Society which has so recently devoted an entire sitting to the discussion of this much vexed question. In fact, the only attempts at its final solution have been those of certain meteorologists who insist on the unqualified adoption of their own views on the subject, in utter disregard of the fact that the variations in local climate may render arrangements, which are fairly satisfactory in their own country, entirely unsuitable in another.

One of the attempts at cutting the gordian knot, by dispensing with screens altogether, has been lately much vaunted in France. This is the use of the Rotatory Thermometer (*Thermomètre fronde*) which was first proposed many

Comparison of Ordinary Dry Bulb Thermometer with the Rotatory Thermometer.

Observations made on board Ship 'Roselle,' Captain E. Heggum.

Date.	Position.		Temperature.			Wind.		Weather.
	Lat.	Long.	Rotatory Thermometer.	Dry Bulb.	Wet Bulb.	Direction.	Force. 0— 12.	
1874.	N.	W.	°	°	°	Points.		
Nov. 7. Noon.	26° 20′	19° 12′	72·1	72·3	68·9	W	1—2	b
,, 9 ,,	23 31	20 13	72·6	75·2	69·8	N 2 E	4	b
,, 10 ,,	20 13	21 21	73·1	75·0	71·0	N 2 E	5	c m
,, 11 ,,	16 57	21 45	76·7	77·6	73·9	N 3 E	5, 6	b m
,, 12 ,,	14 3	21 55	77·8	79·2	74·8	N 1 E	5	b m
,, 13 ,,	11 10	22 7	79·9	82·0	75·9	N 2 E	4	c
,, 14 ,,	8 24	22 7	79·2	78·4	76·8	N 2 W to N 6 E	4, 5	c
,, 15 ,,	6 22	22 41	80·8	81·0	78·2	S 6 E	3, 4	q c
,, 16 ,,	4 40	23 1	81·8	83·8	79·3	S 2 E	4	c
,, 17 ,,	2 45	24 40	80·7	81·9	77·9	S 3 E	4	c
,, 18 ,,	0 48	26 36	81·2	82·0	77·8	S 1 E	4	b
	S.							
,, 19 ,,	1° 12′	28 17	80·7	81·3	76·9	S 3 E	4	b
,, 20 ,,	4 6	30 7	80·5	80·6	75·9	S 3 E	5, 6	b
,, 21 ,,	7 27	32 27	81·2	80·6	73·9	S 4 E	5, 6	b m
,, 22 ,,	9 42	34 14	80·2	81·0	73·6	S 4 E	3	b
,, 23 ,,	12 13	34 47	79·7	80·6	74·1	S 7 E	5	b
,, 24 ,,	15 25	34 2	79·1	79·2	74·1	N 7 E	4, 3	b
,, 25 ,,	18 29	32 25	77·3	78·7	74·5	N 5 E	3, 4	c
,, 26 ,,	22 12	31 57	75·3	76·0	72·5	N 5 E	5	cm
,, 27 ,,	24 45	30 30	73·7	74·0	71·9	N 5 E	3	c
,, 30 ,,	30 36	25 58	69·1	69·9	66·8	N 6 E	4, 3	bm
Dec. 1 ,,	31 7	24 53	70·8	72·0	67·2	—	0, 1	b
,, 2 ,,	31 58	23 51	69·9	70·3	67·7	N 4 E	4	b
,, 3 ,,	32 40	19 10	68·3	67·8	66·1	N 1 E	6, 7	cm
,, 4 ,,	33 17	14 8	68·3	68·1	65·6	N 1 E	5	cm
,, 5 ,,	34 14	10 2	67·9	67·0	64·7	N 2 E	4	cm
,, 6 ,,	35 18	6 54	68·4	69·1	64·6	N 1 E	2, 3	b
,, 7 ,,	36 39	2 48	64·7	64·6	61·0	N 3 E	5	cm
		E.						
,, 8 ,,	38 9	1° 23′	63·0	64·3	60·3	N 2 W	4	b
,, 9 ,,	38 29	5 21	55·4	55·3	51·3	S 2 E	4	c
,, 10 ,,	38 35	8 5	58·0	57·7	53·9	S 2 W	2, 4	c
,, 11 ,,	39 4	10 59	57·3	57·1	52·6	S 4 W	3	c
,, 12 ,,	39 40	15 4	58·0	58·5	56·9	S 3 W	4	c
,, 13 ,,	40 30	20 2	59·2	59·3	56·0	S	6, 5	c
,, 14 ,,	40 43	22 29	61·1	62·8	56·0	S 5 W	1	b
,, 15 ,,	41 7	25 34	64·0	64·9	60·6	N 7 W	5, 4	c m
,, 16 ,,	41 21	30 43	54·8	55·9	51·1	W	5	c m
,, 17 ,,	41 44	35 12	54·1	54·5	50·2	S 5 W	4	c p
,, 18 ,,	42 0	39 40	56·8	55·2	54·8	N 3 W	7, 8	o p
,, 19 ,,	42 0	44 52	49·8	51·1	49·8	S 3 W	8, 6	o
,, 20 ,,	42 12	50 26	41·9	41·5	39·5	S 5 W	6, 7	c q^2
,, 21 ,,	42 17	56 54	46·2	44·4	40·9	S 3 W	7, 8	c q h
,, 22 ,,	41 55	62 58	48·5	45·6	44·0	S	6, 4	c p q
,, 23 ,,	41 55	65 47	52·7	52·3	48·2	N 2 E	5	o
,, 25 ,,	41 8	73 23	58·8	60·1	56·2	S 6 W	2	b m
,, 26 ,,	40 20	77 25	59·1	59·3	57·4	N	5, 6	c m
,, 27 ,,	38 29	82 0	62·8	62·8	62·1	N 3 W	6	c m
,, 28 ,,	35 44	85 1	67·1	66·8	65·8	N 5 W	4	c
,, 29 ,,	33 52	85 58	70·0	69·6	67·4	N 6 W	0, 1	b

COMPARISON OF ORDINARY DRY BULB THERMOMETER—*continued.*

Date.	Position. Lat.	Position. Long.	Temperature. Rotatory Thermometer.	Temperature. Dry Bulb.	Temperature. Wet Bulb.	Wind. Direction.	Wind. Force. 0—12.	Weather.
	S.	E.	°	°	°	Points.		
1874. Dec. 30. Noon.	32° 41′	86° 1′	71·8	71·1	68·4	N 3 E	2	b
„ 31 „	31 25	84 24	71·6	71·6	67·1	N 1 E	3	b
1875. Jan. 1 „	30 21	85 34	72·0	72·3	68·2	N 3 W	1, 2	b
„ 2 „	28 53	86 44	73·9	74·1	70·0	N 3 W	3	b
„ 4 „	26 24	88 9	73·6	74·7	70·4	N 6 E	1	b
„ 5 „	23 59	87 46	75·2	75·3	71·3	N 5 E	4	b
„ 6 „	20 20	87 47	77·7	77·8	74·3	N 7 E	5	b m
„ 7 „	16 14	87 53	81·2	81·4	77·3	N 7 E	6	b
„ 8 „	12 7	88 31	80·6	81·3	79·7	N 7 E	5, 6	c q p
„ 9 „	8 7	88 52	82·9	83·1	79·8	E	5, 6	b
„ 10 „	5 28	88 56	81·6	83·8	80·3	Variable.	1	c
„ 11 „	5 4	89 34	81·9	82·3	80·0	N 2 W	2	c
„ 12 „	4 13	90 21	85·1	85·1	78·8	S	1	b
„ 13 „	3 19	90 45	86·2	86·3	80·5	S	1	c
„ 14 „	2 0	91 14	80·0	80·6	78·1	W	2, 5	c q p
	N.							
„ 15 „	1 54	91 48	83·2	82·2	78·7	N 2 W	4	c m
„ 16 „	3 20	93 6	82·3	83·2	78·4	N 2 W	2	c
„ 17 „	4 49	91 51	82·7	82·5	77·8	N 3 E	4	c
„ 18 „	7 30	89 24	80·3	80·8	73·9	N 2 E	4	b
„ 19 „	8 38	88 11	81·6	81·4	71·4	N 3 E	1	b m
„ 20 „	8 50	88 2	78·7	79·9	72·6	N	1	c m
„ 21 „	9 31	87 10	79·2	81·4	72·7	Calm	0	b
„ 22 „	9 45	86 35	78·4	79·6	72·4	N	2	b
„ 23 „	11 5	85 48	78·8	79·1	73·4	N 3 E	4	b
„ 24 „	14 14	84 57	77·4	78·6	71·3	N 6 E	4	b m
„ 25 „	16 53	84 38	77·8	77·5	70·3	N 6 E	2	b
„ 26 „	18 1	84 51	77·7	78·2	71·8	E	2	b m
Mean of 76 Observations.....			71·6	72·0		Difference of Rotatory on Dry Bulb—0·4.		

With reference to these Observations, Captain Heggum writes:—"As for the difference between the Swinging Thermometer and the bulbs, the Screen is always screwed in front of the poop, so when the sun is ahead and not shaded by the sails, it always rises considerably, especially in the afternoon."

In the above Observations the Dry Bulb may be considered as never wet, since Captain Heggum used a symbol to express such dampness of Dry Bulb when existing.

years ago, but has only of late attracted much attention. This consists of a small thermometer, attached to a string, which is swung round the head for a short time, and then read. It is maintained, by the advocates of this mode of experiment, that such an observation is independent of radiation, and that, whether the thermometer be swung in sunshine or shade, over grass, gravel, or road, the observed temperature will be the same as that obtainable at the same level by the most approved method of exposure in a screen; in fact, some of the advocates of the method maintain that this is the only accurate mode of determining air temperature.

At the Conference on Maritime Meteorology, which was held in London last year, the use of the instrument in question on board ship was proposed by M. Charles Sainte-Claire-Deville, but the idea did not meet with general accept-

ance. It seemed to me, however, to be well worth a trial, and accordingly I requested one of our best observers, Captain Edward Carl V. Heggum, formerly of the 'Czar,' now of the 'Rozelle,' to take one of these instruments, and try it on a voyage. This was done on the voyage from Liverpool to Calcutta, in the winter of 1874-5, and the observations were made at noon daily. I have extracted these, with the temperature by dry bulb, in an ordinary small screen, and have appended the records of the damp bulb, wind and weather at the time.

The result is that we have 76 comparisons, in which the Rotatory Thermometer read below the dry bulb on 52 occasions, was equal to it in 8 instances, and was above it on 21 occasions. Of the 52 observations of defect of the Rotatory Thermometer,

4	were above	2°·0
8	,, between	2°·0 and 1°·5
12	,, ,,	1°·5 ,, 1°·0
15	,, ,,	1°·0 ,, 0°·5
18	,, below	0°·5

Of the 21 observations of excess of the Rotatory Thermometer,

1	exceeded	2°·0
2	were between	2°·0 and 1°·5
1	between	1°·5 ,, 1°·0
5	,,	1°·0 ,, 0°·5
12	below	0°·5

The greatest instance of excess, 2°·9, was just after a gale.

The present communication is necessarily very incomplete, but it seems of interest to place the observations on record, inasmuch as the mean of the 76 observations only differs by 0°·4 from the accepted mean temperature for noon on board the ship.

DISCUSSION.

Dr. TRIPE pointed out the peculiarity that a majority of the observations made in this manner in the sun were below those of the ordinary dry bulb, placed in the screen, instead of being, as he should have expected, a little above it.

Mr. GASTER said that position and nature of the thermometer-screen should be carefully stated, as it might sometimes be in the sun, and sometimes in the shade of the ship's canvas, or be unduly heated by reflection from the deck. It was absolutely necessary that something definite as to the exposure should be given, or the comparisons would prove of no value.

Mr. SYMONS said that it had been found that the bright bulb thermometer does not heat up very much. In the Strathfield Turgiss experiments, a bright bulb thermometer was exposed 20 feet above the ground, in the sun's rays, and the difference was only 1°·0 or 1°·5 above the temperature in the thermometer stand. He understood that Mons. Renou swung the thermometer in the shade. He thought that the difference of 0°·4 was more likely due to the heating up of the screen than to any other cause. The slightness of this difference seemed to imply that observations on board ship must now be more correct than they were formerly considered to be.

Mr. SCOTT said that these results were merely preliminary, and intended to show that the arrangement was practicable. In reply to Dr. Tripe, he observed that if any one would try the experiment of swinging a thermometer in sunshine and in shade, they would find that there was hardly any difference in the readings.

VII. *On the Moon's Influence in connection with Extremes of Temperature.* By GEORGE D. BRUMHAM, F.M.S. (Abstract.)

[Received November 27th.—Read December 15th, 1875.]

IN this communication the author points out a large series of curious coincidences between the occurrence of exceptionally uniform apparent movements of the lunar positions above the horizon, and extremes of atmospheric temperature. Mr. Brumham thinks that the unsettled state of the weather in our climate is due, in a large degree, to the irregular movements and unsymmetrically shifting positions of the moon in the sky, and he supports this opinion by pointing out numerous instances in which the most marked departure of the moon from its irregular movements has been accompanied by *diminished vicissitude* in the weather, and exceptional severity of cold, or enduring prevalence of heat. By 'regularity in the moon's movements" Mr. Brumham means regularity of apparent movement in the sky as the luminary approaches, or leaves, the equinoctial line; and in its method of reaching its extremes of north or south declination. Mr. Brumham conceives that coincidences of the character of those which he adduces establish the fact of some important connection between lunar influences and extremes of atmospheric temperatures upon the earth, but that this influence is "partial," and very materially affected and modified by the circumstances and conditions of place, and that the careful and patient inquiry of "how" and "why" the weather of different localities is differently influenced by the movements of the moon, is one of the offices which meteorological science has at this time to perform.

Mr. Brumham, in this communication, draws particular attention to the frequent recurrence of very severe winters in England at periodical intervals of double the moon's cyclical return to corresponding relations with the earth and sun, which is measured by a period of a trifle more than 81 years. There were exceptionally severe winters in England in 1709 and 1771; in 1740 and 1802; in 1741 and 1808; in 1754 and 1816; in 1768 and 1880; in 1776 and 1838; in 1785 and 1847; in 1798 and 1860; in 1808 and 1870. And as there was a very severe winter in 1814, there should be one in 1876.

PROCEEDINGS AT THE MEETINGS OF THE SOCIETY.

NOVEMBER 17th, 1875.

Ordinary Meeting.

ROBERT JAMES MANN, M.D., F.R.A.S., President, in the Chair.

JAMES CONROY, Tinnahinch Bridge, Rosenallis, Ireland;
MORRIS JONES, L.R.C.P., Aberystwith;
A. H. LEYCESTER, 38 St. James's Place, S.W.;
Sir DAVID LIONEL SALOMONS, Bart., Broom Hill, Tunbridge Wells; and
JAMES PENMAN HUGH WALKER, 11 Delamere Crescent, Harrow Road, W.,
were balloted for and duly elected Fellows of the Society.

The names of four Candidates for admission into the Society were read.

Mr. E. G. ALDRIDGE and Mr. G. M. WHIPPLE were appointed Auditors of the Treasurer's Account.

The following papers were then read:—

"Some Remarks on the reduction of Barometric Readings, with a form of Table for combining the corrections for index-error, temperature, and altitude." By WILLIAM MARRIOTT, F.M.S., ASSISTANT SECRETARY. (p. 1.)

"On a Continuous Self-Registering Thermometer." By W. HARRISON CRIPPS. (p. 6.)

"On a Self-Regulating Atmometer." By SAMUEL H. MILLER, F.R.A.S. (p. 9.)

The Meeting was then adjourned.

DECEMBER 15th, 1875.

Ordinary Meeting.

ROBERT JAMES MANN, M.D., F.R.A.S., President, in the Chair.

WILLIAM ELLIS, F.R.A.S., 88 London Street, Greenwich, S.E.;
KAUFMANN J. MARKS, 14 Warrington Crescent, Maida Hill, W.;
THOMAS READ, 37 Westbourne Park, W.; and
PHILIP WRIGHT, F.C.S., Mellington Hall, Churchstoke, Montgomery,
were balloted for and duly elected Fellows of the Society.

The names of four Candidates for admission into the Society were read.

The following papers were then read:—

"On the Registration of Sunshine." By R. H. SCOTT, M.A., F.R.S. (p. 18.)

"On the Rainfall at Calcutta." By R. STRACHAN, F.M.S. (p. 21.)

"Notes on the use of the Rotatory Thermometer (*Thermomètre fronde*) on board ship." By R. H. SCOTT, M.A., F.R.S. (p. 26.)

"On the Moon's influence in connection with extremes of Temperature." By GEORGE D. BRUMHAM, F.M.S. (p. 30.)

Mr. SCOTT exhibited a complete set of instruments, with Thermometer Screen, &c. as used at the Russian Meteorological Stations.

The Meeting was then adjourned.

Donations received from October 1st to December 31st, 1875.

Presented by Societies, Institutions, &c.

Bagnères	Société Ramond	Note sur les Observations Météorologiques faites en 1874, au Pic du Midi de Bigorre.
	,, ,,	Ascensions et Observations faites au Pic, pendant l'hiver 1873-1874.
	,, ,,	Resumé des Observations Météorologiques faites à Barèges (1,232m.), à l'Observatoire de la Station Plantade (2,366m.) et au Sommet du Pic (2,877m.) à midi 43'.
Bath	Royal Literary and Scientific Institution	Summary of Meteorological Observations made during the months of August to November.
Bombay	Colaba Observatory	Report on the Condition and Proceedings of the Government Observatory for the year which ended with the 30th June, 1875. By C. Chambers, F.R.S., Superintendent.
Brisbane	General Registry Office ..	Fourteenth Annual Report from the Registrar-General on Vital Statistics. By H. Scott Registrar-General.
Brussels	Observatoire Royal.....	Annales, May to December, 1874; September and October, 1875.
Calcutta	Meteorological Office	Report of the Meteorological Reporter to the Government of Bengal, 1874.
	,, ,,	Administration Report of ditto, 1874-1875.
	,, ,,	Report of the Midnapore and Bardwan Cyclones of the 15th and 16th of October, 1874. By W. G. Wilson, M.A., L.C.E.
Copenhagen ..	Danske Meteorologiske Institut	Bulletin Météorologique du Nord, September 1 to November 30. By Captain N. Hoffmeyer, Director.
Cracow	K. K. Sternwarte	Meteorologische Beobachtungen, September and October. By Dr. F. Karlinski, Director.
Dublin.....	Royal Irish Academy .	Proceedings, Science, Vol. I., No. 9; Vol. II., Nos. 1-3. Polite Literature, Vol I., No. 10.
	,, ,,	Transactions, Science, Vol. xxv., Parts 5-19.
Fiume	I. R. Accademia di Marina	Meteorological Observations, September.
Klagenfurt	Sternwarte	Meteorologische Beobachtungen, October.
Liverpool	Bidston Observatory	Report of the Astronomer to the Marine Committee, Mersey Docks and Harbour Board for the years 1873 and 1874. By J. Hartnup, F.R.A.S., Astronomer.
	Literary and Philosophical Society	Proceedings, 1874-1875, No. xxix.
London	Army Medical Department	Report for the year 1873, Vol. xv.
	General Register Office ..	Weekly Return of Births and Deaths, Nos. 39-51.
	,, ,,	Quarterly Return of Marriages, Births, and Deaths, September 30. By the Registrar-General.
	Meteorological Office	Daily Weather Report and Charts.

London	Meteorological Office	Hourly Readings from the Self-Recording Instruments at the Seven Observatories in connection with the Meteorological Office. May and June.
	,, ,,	VI. Jahresbericht der meteorologischen Centralanstation, Carlsruhe, über die Ergebnisse der an den meteorologischen Stationen des Grossherzogthums Baden im Jahre, 1874, angestellten Beobachtungen. Bearbeitet von Oscar Ruppel.
	,, ,,	Meteorological Register kept at Port Arthur, Van Diemen's Land, by T. J. Lempriere, May 1837 to January 1840; January 184 to December 1842. (MS.)
	,, ,,	Manual and Instructions for the Arctic Expedition, 1875.
	,, ,,	Meteorological Observations at the United States Naval Observatory, made during the year 1873.
	,, ,,	Contributions to Terrestrial Magnetism, No. xiv. By General Sir Edward Sabine, F.R.S.
		By the Meteorological Committee.
	Royal Institution	Proceedings, Vol. vii., Part vi.
	Royal Society	Proceedings, Vol. xxiii., Nos. 163 and 164.
	Royal United Service Institution	Journal, Vol. xix., No. 83.
Melbourne	Government Observatory	Monthly Record of Results of Observations in Meteorology, Terrestrial Magnetism, &c. February to May.
	,, ,,	Results of Ditto for the year 1873.
		By R. J. Ellery, F.R.S., Government Astronomer.
Paris.....	Observatoire de Montsouris	Bulletin Mensuel, Nos. 44-47.
		By M. Marié Davy, Director.
	Observatoire National ..	Bulletin International.
		By M. U. J. Le Verrier, Director.
	Société Météorologique de France	Nouvelles Météorologiques. September to November
	,, ,,	Annuaire, Tome xix., 1871. Tableaux Météorologiques, Feuilles 6-14.
Philadelphia ..	American Philosophical Society	Proceedings, No. 94.
	,, ,,	Transactions, Vol. xv., New Series, Part ii.
Rome	Osservatorio del Collegio Romano	Bullettino Meteorologico. June to November.
		By Padre A. Secchi, Director.
Sydney	Government Observatory	Meteorological Observations. May to July.
		By H. C. Russell, B.A., F.R.A.S., Government Astronomer.
Toronto	Education Office	Journal of Education. September to November.
		By Rev. E. Ryerson, D.D., Superintendent.
Upsala.....	Observatoire de l'Université	Bulletin Météorologique Mensuel, Vol. vii., Nos. 1-5, January to May.
		By H. H. Hildebrandsson, Director.
Vienna	K. K. Centralanstalt für Meteorologie und Erdmagnetismus	Beobachtungen. September and October.
		By Dr. C. Jelinek, Director.
	Oesterreichische Gesellschaft für Meteorologie	Zeitschrift, Band x., Nos. 19-24.
Washington ..	War Department.....	Monthly Weather Review. September to November.
		By Brigadier-Gen. A. J. Myer, Chief Signal Officer.
Watford	Natural History Society	Transactions, November, Vol. i., Part ii.

Presented by Individuals.

Aldridge, E. G.	The Climate of Eastern and South-Western England. By E. G. Aldridge. Letter to the 'Torquay Directory.'
Beilby, J. Wood.....	Reasons suggestive of Mining on Physical Principles for Gold and Coal. A Review of the Assumptions of Geologists. By J. Wood Beilby.
Blanford, H. F., F.G.S. ..	On some recent Evidence of the Variation of the Sun's Heat. By H. F. Blanford, F.G.S.
Clift, H. A.....	The Weather at Harbour Grace, Newfoundland, September and October. (MS.)
Crookes, W., F.R.S.....	The Electrical News and Telegraphic Reporter. Nos. 14-20.
Dove, W. H.....	Preussische Statistik XXXIV.; Monatliche Mittel des Jahrganges 1874 für Druck, Temperatur, Feuchtigkeit und Niederschläge und fünftägige Wärmemittel.
,, ...	Uber das mittlere Fortschreiten ungewöhnlicher Wärmeerscheinungen über die Erdoberfläche.
,, ...	Uber den allgemeinen Character milder Winter.
,, ...	Kühler Mai nach mildem Januar.
,, ...	Nachtrag zu der im Juni gelesene Abhandlung "Kühler Mai nach mildem Januar."
,, ...	Ueber die Uebereinstimmung der Witterungserscheinungen in den ungewöhnlich trockenen Jahren 1857, 1858, 1874.
Dunlop, W. H.	Results of Meteorological Observations made at Annanhill, Kilmarnock, Ayr, September to November.
Fox, C. B., M.D.....	Meteorological Observations of the Humidity of the Air at Scarbro', with Chapters on Rain, Rain Gauges, and Rainfall Investigations, and on the Humidity of the Atmosphere in relation to Disease. By Cornelius B. Fox, M.D.
,, ...	Ozone and Antozone, their History and Nature. When, Where, Why, How is Ozone observed in the Atmosphere. By Cornelius B. Fox, M.D.
,, ...	The Disposal of the Slop water of Villages. By Cornelius B. Fox, M.D.
,, ...	Water Analysis as it should, and as it should not, be performed by the Medical Officer of Health. By Cornelius B. Fox, M.D.
Gardiner, G.....	A Series of Meteorological Observations taken at Rio Grande do Sul from June, 1874, to May, 1875. By Robert H. Harrison (MS.).
Hankinson, R. C.....	Summary of Meteorological Observations taken at Red Lodge, Southampton, September to November (MS.).
Higgs, Rev. W., L.L.D. ..	The Telegraphic Journal and Electrical Review, Nos. 64-69.
Hoskins, S. E., M.D., F.R.S.	Meteorological Observations taken at Guernsey, September to November.
Lake, W. C., M.D.....	On the Comparative Meteorology of Devonshire. By W. C. Lake, M.D.
Laughton, J. K.....	A Discourse concerning the Origine and Properties of Wind, With an Historicall Account of Hurricanes and other Tempestuous Winds. By R Bohun (1671).
,, ...	Reflexions sur la cause générale des Vents. Par M. d'Alembert (1747).
,, ...	Observations on the Winds and Monsoons; illustrated with a Chart, and accompanied with Notes Geographical and Meteorological. By James Capper (1801).
,, ...	Tableaux des Vents, des Marées et des courants qui ont été observés sur toutes les mers du Globe; avec des réflexions sur ces Phénomènes, par Ch. Romme. Tomes I. and II. (1806).
McLandsborough J.F.R.A.S	Meteorology of Bradford for 1874.
,, ...	Borough of Bradford; its Mortality and Meteorology, January 2nd, 1869, to January 2nd, 1875.
Miller, S. H., F.R.A.S. ..	The Fenland Meteorological Register and Weather Report, October to December.
Mohn, Dr. H.....	Oversight over Veirforholdene i Norge i Aaret 1874. Af. H. Mohn.
Munn, A.	Observations taken with Dr. Schönbein's Ozonometer at Harbour Grace, Newfoundland, from July 1st to September 30th. By A. Munn (MS.).

Preston, Rev. T. A., M.A.	Meteorological Journals kept at Marlborough College during the years 1873 and 1874. (M.S.)
Puckle, Col. J.	Meteorological Observations for every day in the year, for the years 1859, 1860, and 1861; together with Abstracts of the record of the five years from 1862 to 1866 inclusive; with a Rainfall Table for Bangalore, Shemoga, Toomkoor, and Mysore, for thirty years, and Charts in illustration of the Tables. With recently added information. By Major J. Puckle.
Quetelet, E.	Etoiles Filantes. Les Persèides en 1875. Observations faites à l'Observatoire Royal de Bruxelles.
Scott, R. H., M.A., F.R.S.	On the Spectrum of the Aurora (Extract of Letter from Professor Herschel).
,, ...	Domestic Water Supply Arrangements. By W. R. Maguire.
Silver, S. W.	The Colonies. Nos. 196-202.
Simpson, J. O.	Rainfall on the Coast of Natal.
Strachey, Gen. R., F.R.S.	Chart of Average Rainfall in Northern India.
Symons, G. J.	Symons's Monthly Meteorological Magazine. October to December.
,, ...	Memoir on the Cholera at Oxford, in the year 1854, with Considerations suggested by the Epidemic. By Henry Wentworth Acland, M.D., F.R.S.
,, ...	A Treatise on the Causes and Principles of Meteorological Phenomena; also two Essays; the one on Marsh Fevers, the other on the System of Equality proposed by Mr. Owen, of New Lanark, for ameliorating the condition of Mankind. By Graham Hutchinson.
,, ...	An Essay on the Cause of Rain, and its allied Phenomena. By G. A. Rowell.
,, ...	Report of the Astronomer Royal to the Board of Visitors of the Royal Observatory, Greenwich; read at the Annual Visitation of the Royal Observatory, 1868, June 6.
,, ...	Report of the Meteorological Department of the Board of Trade, 1858.
,, ...	Astronomical Observations made at the Royal Observatory, Edinburgh. By Charles Piazzi Smyth. Vol. xii., for 1855-1859.
,, ...	Catalogue of the Scientific Books in the Library of the Royal Society. (1839)
,, ...	Cardiff Naturalists' Society. Report and Transactions. Vol. v., 1873.
,, ...	Records and Results of a Magnetic Survey of Pennsylvania and Parts of Adjacent States, in 1840 and 1841, with some additional Records and Results of 1834-1835, 1843, and 1862, and a Map. By A. D. Bache, LL.D., F.R.S.
,, ...	Périodicité des Grands Déluges resultant du mouvement graduel de la ligne des Apsides de la terre. Théorie prouvée par les faits Géologiques. Par H. Le Hon.
,, ...	Nouvelle Théorie des Hydrométéores suivie d'un Mémoire sur l'Electricité Atmosphérique et d'un autre sur la Pluviométrie. Par M. P. H. Maille.
,, ...	De la Pluie en Europe. Par le Commandant Rozet.
,, ...	Sur la non-existence, sous le ciel du Mexique, de la grande pluie d'étoiles filantes de Novembre, 1866, et du Retour périodique du mois d'Août. Par M. A. Poëy.
,, ...	Resumé des Observations Météorologiques faites à Ostende en 1862. Par M. J. Cavalier.
,, ...	Observations Météorologiques faites à Nijne-Taguilsk et à Vicimo-Outkinsk (Monts Oural), Gouvernement de Perm. Années 1841, 1843, et 1844.
Taylor and Francis, Messrs.	Taylor's Calendar of the Meetings of the Scientific Bodies of London for 1875-1876.
Tennent, R., F.R.S.E.	The Theory of the Causes by which Storms progress in an Easterly Direction over the British Isles, and why the Barometer does not always indicate real vertical pressure. By Robert Tennent.
The Editor	"Nature," Nos. 309-322.
,, ...	"Public Health," Nos. 45-47 and 49.
,, ...	"The Academy," Nos. 178-190.

Tripe, J. W., M.D.	On a Constant Water Supply for London. By J. F. Bateman, F.R.S., T. Beggs, and W. Rendle.
,, ...	London Water-Supply. Outline of the Plan for the proposed supply of Water to London, from the Sources of the River Wye in South Wales. By Hamilton H. Fulton.
,, ...	Canterbury Gas and Water. New Water-Supply.
,, ...	East London Water Works. Future Supply within the Metropolis.
,, ...	Microscopical Examination of Certain Waters submitted to Jabez Hogg, and a Chemical Analysis by Dugald Campbell, with Introductory Notes by S. C. Homersham.
,, ...	Man. The General principles of Climatology and their application to the Climates of the South-East and South-West of France. By Sir Alexander Taylor, K.B., M.D.
Turtle, L.	The Weather at Aghalee, Lurgan, October and November.
Ward, Col. M. F.	Résumé des Observations Météorologiques faites à Rossinières par M. M. Henchox, de 1799 à 1850, par Professeur C. Dufour.
Winstanley, D., F.R.A.S...	Meteorological Report of the diurnal aggregate of chemical force in the daylight of the Southern sky from observations made at Blackpool during the month of September, 1875 (MS.).

QUARTERLY JOURNAL

OF

THE METEOROLOGICAL SOCIETY.

VOL. III. No. 18.

An Address delivered by the President, ROBERT JAMES MANN, M.D., F.R.A.S., *at the Annual General Meeting, January 19th*, 1876.

THE Report of the Council, drawn up as an authoritative account of the work accomplished during the past year, which has just been read, has been so carefully prepared, and is so full and circumstantial in its detail, that it goes very far to forestall all that a President could most appropriately say at an Anniversary Meeting of the gentlemen associated in Fellowship around his chair. It therefore happily falls to my share to have to play but a subordinate and secondary part in the proceedings of the evening, and I am the more glad that it is so, because the mere accident of a change in the arrangements of the Sessional work, and of the election of Officers during the term of my presidency, has been the cause of my having to make a third appearance before you in this particular rôle. Under the circumstances of this contingency, I intend to leave the Report of the Council to speak for itself upon the general theme of object and progress, and to confine myself to a brief special allusion to certain matters of practical interest that are suggested to me by some passages of this official document.

The first impulse that naturally arises in the prosecution of this object is to express somewhat pointedly the strong satisfaction I necessarily experience in the sense that during my presidency a series of carefully-equipped Observatories have been auspiciously organised under the superintendence of the Society, and that England is, consequently, now widely covered with observing Stations amenable to our own management and rule, from which meteorological returns are made that are substantially equivalent and strictly comparable. The expression of this feeling on my part, however, affords me a fitting opportunity to add a few words on a bearing of the subject, which has

occupied my thoughts, to a considerable extent, for some time, and which therefore I may perhaps venture once again to touch before I vacate my seat at the head of your Council;—I allude to the value and proper position of Observational Meteorology in the family of the sciences.

Any thoughtful *appraisement* of the circumstances which have attended the marvellous progress of human knowledge within the recent epochs of current history, leaves the conviction upon the mind that instead of there being any intrinsic superiority in either of the two opposite methods of scientific investigation, namely, the deductive and the inductive, as has been too commonly claimed by the special advocates of those methods,—there is, on the contrary, an equality and fraternity,—a kind of mutual dependence and special co-ordination,—in them, each method having a proper function and place of its own in the great work of intellectual movement and human enlightenment, and each method being the indispensable counterpart and complement of the other in a systematic plan of intellectual progress. In all the great branches of human knowledge with which the intellect of man has hitherto had concern, the lightning flash of intuitive deduction has marked out a path which has afterwards been, often painfully and laboriously, but always successfully, followed up by the halting footsteps of inductive elaboration and correction. A mere casual reference to the historical records of the various departments of physical science at once supplies ready and ample illustrations of this truth. In the case of physical astronomy, the grandest of all the deductive efforts of the human mind—that, namely, which was marked by Newton's enunciation of the Law of Universal Gravitation,—has been followed by two centuries of detailed labour with the stars, at Greenwich and elsewhere, in which many hundreds of men have been employed in the accumulation of many hundreds of thousands of trivial facts, such as the fractions of the moments at which certain of the celestial luminaries have passed fixed stages of their endless journey in their daily recurring rounds. This is done, as has been aptly said, for the *perfecting* of the Lunar Theory, or, in other words, for the testing and elaboration of the Newtonian hypothesis. In our own days the deductive suspicion that the sun is three millions of miles nearer to the earth than it was conceived to be in the earlier astronomy, has, as we all know, covered the broad earth with expeditions sent out to the remotest regions of the globe to watch the passage of Venus across the solar face, as a mere subordinate incident in which process we hear of two hundred and sixty chronometers having been caused to make single and double journeys over long stretches of the ocean, and of ten thousand telegraph messages being exchanged between observers at distant stations. No competent authority doubts, in these instances, the necessity for all this persevering labour and supplementary toil. It is admitted, on all hands, as a kind of self-evident fact, that the first deductive glimpse of the scientific principle and law requires all this elaborate and patient application of inductive scrutiny, before these can be adequately and properly turned to account in the further processes of investigation and discovery.

The same illustration is encountered again and again in almost every path

of human inquiry. Deduction leads the way, and marks out the course, and induction then takes up the running, and tracks the half-seen truth home to its hidden lair; and with this sleuth-hound set upon the trail, it is hardly too much to say that there is no deductive flash of intellect that may not be followed to a serviceable end. It was in this way that—after it had been seen that the tides of the sea were caused by the gravitating pull of the sun and the moon upon the fluent substance of the ocean—it was found that the actual tidal waves are liquid vibrations propagated through basins of limited depth, under a special law of their own, after the equilibrium of the fluent mass has been primarily disturbed by the cosmical influence acting from without. It was in this way that, after the brilliant idea of the combining proportions of elementary substances had been conceived by Dalton, it was ascertained that the elaborated theory could be applied even to the formation of new compounds of great economical value, and previously unknown. It was in this way that, after Avogadro had perceived that the same number of molecules are contained in similar volumes of all elementary bodies, when converted into the state of gas, and when placed in analogous condition of pressure and temperature,—it was ascertained that Avogadro's comprehensive law could be made an infallible guide through all the complexities and perplexities of intrinsic density, specific gravity, and specific heat, and that it could be turned into an arithmetical rule for the exact estimation of chemical quantities. In reference to the most recent of these grand inspirations of physical science,—Kirchoff's construction and application of the compound spectroscope to purposes of chemical and astronomical discovery,—he would indeed be a rash and presumptuous prophet who would venture to say how many generations of ever-extending and ever-multiplying observations will have to be passed before the sublime insight of Kirchoff can be held to have established itself in its proper place in the doctrines of science, and in the methods of ultimate research.

Now Meteorology stands, in no sense, in a different position in these matters to its sister departments of Physical Research. It is, it is true, a younger science than some of its compeers, and it holds ground of a very broken and complicated character, and deals with details of perplexing multiplicity and variability. But it has, nevertheless, had its bright outbursts of prophetic induction. The deductive perception of the great physical agency expressed in the barometric gradients of the atmosphere, and the law of the movements of the air in reference to the position and drift of high and low pressure areas, are essentially comparable with the discovery of the dynamic theory of the tides in oceanic physics, and with Avogadro's hypothesis of the molecular uniformity of the different gases in chemical physics; and the special work of Meteorological Science at the present time is the tracking down of those prophetic generalisations to their practical applications, and to their elaborated end.

But, in carrying out the inductive investigations which are necessary for the elaboration and perfection of the premonitions of science, it is of the utmost importance that those investigations should be directed by an intel-

ligent appreciation of the issue that is looked for;—that they should constitute a well-considered and pre-determined system; and for the very reason that has already been alluded to, namely, that Meteorology has to deal with so complex and protæan a series of elements, this is even more essential in its case than it is in that of many of the collateral branches of physical inquiry. It is the too general neglect, indeed, of this condition in meteorological work that is mainly responsible for the reproach which is so commonly made to its votaries, of spending their lives in heaping together ever-increasing piles of heterogeneous figures and unintelligible records.

The purpose of the Meteorological Society in the establishment of its new series of observing stations has substantially been to organise a group of connected observatories in which systematic, and strictly comparable, observations may be carried on with a view to the specific and periodical discussion of the results. On this account the most strenuous care has been taken not to multiply needlessly the stations of observation, but to select them on the ground of topographical position and fitness. The most absolute uniformity in the character and conditions of the instruments has been secured by the definite inspection and registration of the circumstances and equipment of each station. I could not, perhaps, more forcibly or more adequately express the view which I here desire to enforce, and which has been present to the Council in dealing with these details, than by repeating the terse words of one of our own Secretaries, which appeared in the 'Times' of Christmas-day in connection with a correction of a misapprehension of the position of the Society in another particular:—"The requisite in Meteorological Science now is, not observations, but brains to work out the results." It is in this sense that systematised and superintended observations are required, and that the arrangements have been entered upon, which are so clearly and so fully described in the Report of the Council. The Members of Council who are responsible for its conception and statements, certainly do entertain a very sanguine expectation and hope that important practical results will speedily follow from the establishment of these Observatories, and that they will afford a valuable contribution to the knowledge of the climate of England.

As the personal experiences of individuals very commonly afford the most intelligible explanation of the grounds of their convictions, I may, perhaps, be permitted here very briefly to say why I myself have a very confident belief that such a result will follow from this action of the Council. Some eighteen years ago the accidents of my life led me for a somewhat lengthened sojourn to a young colony on the south-eastern coast of Africa. When I landed there I found that no one to whom I referred could give me any very exact or definite idea of the climate of the place. Almost every old colonist described something that materially differed from the account that was rendered by his next-door neighbour. During eight years I then made my own exact and systematised observations; and when, at the end of the eight years, I left the colony, it was only necessary for me to compare the conclusions at which I had arrived with the accounts which I had received in response to my early inquiries, to satisfy my own mind as to what syste-

matically organised observational Meteorology may be made to do. My own work was, nevertheless, carried on single-handed during the eight years, and it now continually recurs to me to feel how infinitely more valuable my own results and deductions would have been if I could have had at my command some such organisation as we now contemplate here in our present proceedings.

The maintenance of special observations at good central spots for the continuous automatic record of the meteorological conditions of the atmosphere I hold also to be of the utmost practical importance. I certainly cannot agree in the notion that their only practical use is the establishment of the law of "diurnal variation." In referring to the various abstracts of meteorological information that are now supplied from various sources, I am continually impressed with the dimininution of their usefulness from the want in connection with them of a continuous record from some standard and representative station. Thus, to endeavour to make my meaning in this particular more clear by an illustration drawn from a special instance, I observe that in Luke Howard's statement of the characteristics of the Climate of London, he gives as a deduction from the averaged observations of ten years, for the numerical expression of the relative prevalence of north and east winds, and of south and west winds, at London, for the first four months of the year

	NE.	SW.
January	6·8	7·0
February	3·2	11·7
March	9·8	6·6
April	8·3	6·0

Now it is obvious that if this abstract deduction be taken alone a very erroneous impression of an important fact is derived. In these figures the long steady continuance of a cold current in these months, which is of such frequent occurrence, is broken up and masked by the fusion with it of the alternative instances when a warm current of the atmosphere has prevailed at the same period. A direct reference to a continuous automatic record of the movements of the wind during those months would certainly show that a north and east wind blows steadily over London very commonly at that season for considerably more than nine consecutive days, which is the longest period marked in Luke Howard's record; and we are all quite aware what an important practical circumstance in any reference to the climate of London the occurrence and continuance of a north-east wind is. It is the prevalence of the north, or of the south, current of the atmosphere, which makes all the difference between a genial mildness and a biting inclemency in the season.

But the maintenance of fixed observatories for continuous standard automatic records is obviously a task that lies beyond the present pecuniary resources, and so outside of the proper functions of a Society constituted like our own. It is manifestly one of the paternal cares that the community has to receive from the hands of the State. It is a service which has to be

provided for itself by the community at large, that is benefited by the arrangement, rather than by a narrow section of that community, which can only deal with the more limited and less costly ranges of inquiry. Observatories for Standard Automatic Records, Maritime Investigations, Storm Warnings, and Weather Telegraphy, are all the proper charge of the State. I must frankly confess, however, that I by no means desire to see the operations of the State too rigidly limited even to the larger operations of this class. I do not assent, by any means, to the dogma that learned Societies are necessarily "emasculated" by Government aid. They would be so if it were the practice of the Government to connect with such aid the condition of an autocratic rule claiming proprietary rights in the Society on the ground of the assistance. That, however, I need scarcely remark, is a danger which in the present day learned Societies have more to fear from within than from without,—from individuals in their own following rather than from the established authorities of the State. A small help, judiciously applied, very often fosters a struggling spark into a serviceable flame. I have myself known such desirable results to follow State aid to science in numerous instances, and I certainly hold that science should have every help that can be secured to it. To my own mind the advancement of science is a sacred cause which should be ministered to by every one to the utmost of his ability, whether acting as an individual unit in the mass, or as the administrator of a trust that has been placed in his hands for the advantage of his kind. It is, of course, well that any Society which is circumstanced like our own, should do all that it can, by the strength of its own purposes, and by the application of its own intellect and hands, for the cause which it has at heart; but it would be simply a course of suicidal weakness and folly, on this account, to refuse any supplementary assistance that may fall in its way while pursuing its path of honest and earnest work. The one indispensable condition upon which such assistance can be received, namely, the preservation of unqualified independence of action on its own part, is so obvious that it may be taken to be self-evident in the circumstances of the case. It is not possible to conceive that any body of intelligent and high-minded men, acting together as the Managing Council of a learned Society, could lose sight of that condition. It, therefore, is an affair that may very safely be left to the current of events.

The incidental allusion to the influence which the direction of the wind exerts upon the weather, suggests to me to hazard a passing remark upon a mistake which appears to be somewhat prevalent just now, in consequence of some recently published accounts of Dr. Carpenter's notable investigations of the movements of the great ocean currents, and of their influence upon the distribution of temperature. It is somewhat generally conceived that the tendency of these researches has been, as was characteristically said to me in a note of inquiry from a highly-cultivated and intelligent friend within the last few days, "to depose the Gulf Stream from its long-held position of arch guardian of the mild geniality of the English winter." The exact fact of the modification of the theory which has led to this misapprehension is, however, merely that it is a vast general superficial movement of the warm waters of

the equatorial tract of the ocean towards the north, of which the Gulf Stream current is but a subordinate part, which insures this result; and that it is by the intermediation of the south-westerly winds, rather than by the actual washing of the sea-shore by the warm current of water, that the effect is brought about. In reference to the Gulf Stream itself, it is proved that it pretty well loses its direct heating power through thinning and diffusion, and through gradual cooling, by the time it has reached the Mid-Atlantic meridian of 30° west; but it is also as distinctly affirmed that what the Gulf Stream loses in temperature in this process of cooling during its north-westward progress it communicates to the air, and that the south-west wind then carries on this accession of a higher temperature with it to parallels of latitude far further north than those which include the British Isles. The philosophic point that is prominently involved in this most interesting arrangement of the movements of the ocean and air, is that even in the hottest regions of the globe the surface of the ocean does not get heated to a temperature in excess of 86°, because all the power of the sun which would be required to raise the water above that degree, is effectually employed in converting it into vapour, and in maintaining it in that elastic state, instead of in the increase of its sensible temperature; and that that excess is again returned to the air as serviceable and sensible warmth, when the elastic vapour is deposited in the form of rain or snow. One of the expressions which has materially tended to give the strained interpretation to Dr. Carpenter's view in regard to the climatic influence of the Gulf Stream, is his incidental remark that the great difference of temperature of the French and American coasts, in the same parallels of latitude, must be ascribed to the cooling effects of the glacial surface stream which sets southwards along the shores of Nova Scotia and the United States, rather than to the warming effect of the Gulf Stream upon the eastern sea-board of the Atlantic. The real assumption of Dr. Carpenter, however, is that there are two distinct circulations in the wide ocean spaces of the earth,—one a superficial circulation, sustained by the driving power of the prevalent winds, and the other a vertical circulation, established and maintained by the direct gravitation pressure of heavy cold water upon lighter warm water, and manifested in a deep glacial current from the poles to the equator, and in a warm surface current from the equator to the poles; and that the north-western coasts of Europe are materially warmed by both these influences.

The vertical circulation of the great ocean, suggested in the first instance by the French philosopher Pouilliet, and since then so strenuously advocated by Dr. Carpenter, is necessarily of deep interest to ourselves, on account of the marvellous analogy which it suggests between the dynamical mechanism of the ocean and the air. The vertical oceanic circulation, if ultimately established upon the base which has been assumed by Pouilliet and Carpenter, would virtually be an extension of the law of the barometric gradient from the atmosphere to the sea; and would only require that specific gravities in the wide ocean, at determined depths and fixed distances, should be known, in order that the set and velocity of the sea-currents might also be expressed and formulated.

In the Report of the Council which has afforded me the opportunity for these remarks, there is one other topic touched upon which I may perhaps also be permitted very briefly to allude to, on account of the part I have personally taken, and the interest which I have found, in suggesting its consideration to my colleagues. I allude to the establishment of a Permanent Committee for investigating the phemomena of Atmospheric Electricity and the effects of Lightning, and for the diffusion of sound principles in reference to provisions made for defence against the destructive meteor.

In taking up the thread of what I desire to say upon this theme, I can hardly neglect to draw your attention to the very admirable and interesting account of the accident from lightning at Roundham Head, near Torquay, with which we were favoured at one of our Sessional Meetings in the past year by Mr. D. Pidgeon, who was able to give force to his instructive narrative by the argument of "Magna pars fui," which is always interesting from the mouth of one who is relating effects which he has himself experienced. I should also add, that this narrative, which was printed in the October number of our Quarterly Journal, has rendered us a double service, and has laid a double obligation upon us, on account of the example which it sets in its very clear and exact description of facts, and in its very full and sagacious selection of essential characteristics of the way in which it is desirable such communications should be presented for the discussions of our Committee.

One of the most notable facts which is brought under notice in this communication from Mr. Pidgeon, is the rupture of the links of the mooring chains attached to the bottom of the stays of the flag-staff. The staff itself, which was involved in this accident, consisted of a stout mast fifty feet high, stayed with four galvanized iron guy ropes at about twenty-five feet from the ground. Each wire rope terminated about twelve inches above the ground in half-inch cable chains, which were carried down to an anchorage in a subsoil of very dry red sandstone conglomerate.

The entire mast above the attachment of the guys was shattered into splinters by the lightning discharge; and three of the mooring chains below were broken across, several links in each chain being severed. About twenty links altogether were fractured, and of these some were above, and some within, the ground. Several of the broken links had been considerably corroded by rust, but in those the parts severed were the undiminished portions of the iron, and not the segments which had been eaten away by the corrosion. In one place a bent hook of one-tenth of an inch iron wire, which had been used as a substitute for a previously damaged link, was uninjured by the discharge, although several of the links in the same stretch of chain were severed. The broken surfaces in the damaged links were bright and crystalline, and gave no indications of the metal having been subjected to great heat. It is much to be regretted that the whole of the broken links of these chains were not carefully preserved for a further examination of their conducting capacity. Mr. Pidgeon very kindly did what he could to recover them after his attention had been drawn to their scientific value, but unfortunately without success.

Some important practical considerations hang immediately upon the history of these damaged chains. The great increase in the molecular disturbance set up by the discharge at the lower extremity of the conducting system in consequence of the insufficiency of the earth contact is very well illustrated. The distribution of the disruptive discharge through all the several branches of the earth contact is also expressed. Three of the four mooring chains, which were directed out to four opposite points of the compass, were severed. But the most important circumstance connected with the breaking of these chains, is the number of the links which were affected by the disruption, and that those which were injured were broken through the parts of largest metallic area, and not through the lines of diminished section where it might have been expected the greatest resistance to the electrical transmission would have been found. Prof. Melsens, of Brussels, one of the Foreign Members of our Committee, whose attention I have drawn to this circumstance, thinks that the highly crystalline condition of the iron of the broken links indicates that those parts of the chain had already undergone considerable molecular disintegration and change subsequently to their first attachment to the guy ropes, in consequence of the incessant vibration to which they had been subjected under the play of the wind, and he believes that they had been thereby reduced to their lowest cohesive capacity at the spots where the disruption occurred. He takes the uninjured integrity of the new piece of fibrous wire of so much smaller dimensions as furnishing a substantial proof of this view of the matter.

In further illustration of the point which is here glanced at, namely the power of electrical discharges of high tension to produce molecular disturbance in even conducting metallic substance, I have another very curious instance to place before you. Some years ago it happened, during a severe thunderstorm in Natal, that a small house of public entertainment, known as the German House, and standing upon the high road between the seaport and the capital, was struck by lightning and burned. Upon one part of the ruin, where there had been a tin box containing money, the curious object which I now present to the Meeting was afterwards found, as all that remained of the tin box and the money. It consists of a fragment of a half sovereign in gold inseparably welded to a little piece of tinned sheet iron. The entire fragment weighs 75 grains, and of these about 30 grains are gold, and the rest iron. Something more than half of the gold coin has disappeared, and the remnant is eaten out into an irregular crescentic form, with one blunt horn projecting beyond the iron. The rest of the gold piece, comprising about one third of a square inch of superficial area, is metallically connected with the iron by an actual brazing together of the particles of the iron and the gold, and the tinned surface of the iron beyond the attachment is bronzed by a thin film of gold particles that have been scattered over it at the instant of the brazing. The fragment of the iron plate is an inch long, by three-fifths of an inch broad. The 'gnawed out' aspect of the gold coin, where the remnant has been left by the electric tooth which has consumed the rest, is very curious. A marginal band of lighter-coloured gold, that looks as if it had been alloyed so far,

either with tin or iron, is set round the sinuous edge of the erosion, and there is a central 'pivot-head' like spot in the middle of the attachment of the iron and gold which is characterised by the same 'amalgam-like' hue.

Professor Melsens, who is Professor of Physics and Chemistry at the School of Veterinary Medicine of the Belgian Government in Brussels, and to whom I have already made some allusion, as one of the Foreign Members of our Lightning Rod Committee, has been for some time engaged with a very interesting series of experiments in regard to the capacity of copper and iron to transmit electrical force, and to the disintegrating effects that are produced by discharges of high tension. When I was recently in Brussels, the Professor did me the favour to show me many of these experiments at his laboratory, and to explain his views at some length, and it gives me great satisfaction to have this opportunity to make a somewhat public acknowledgement of the consideration and courtesy which I received at his hands upon that occasion, as well as of the readiness he has shown at other times to give me his aid and counsel.

In one of his experiments, Mons. Melsens undertakes to demonstrate that the old electrical dogma, which affirms that an electrical discharge of necessity takes the shortest and easiest path, is one that needs to be entertained with distrust and doubt. The Professor has constructed a kind of gridiron of metal, which has a straight stem of large size passing as a direct road through its centre, and also a series of roundabout lateral passages formed by small wires ranging on the right and on the left of the central stem. When energetic discharges from a Rhumkorff coil are passed through the short, direct, and amply capacious route of the large central stem, smart shocks are simultaneously communicated to any finger that is presented to the small lateral wires. The electrical discharge here manifestly passes through the whole metallic mass, and not only through the most direct path of its straight central stem. A considerable amount of the escaping force goes out of its way to traverse the roundabout and devious route of small capacity, although the broad straight path of large capacity is open immediately before it. The equal distribution of the electrical discharge through many possible routes of conducting material is also ingeniously and pleasingly shown by offering a number of very fine wires of equal capacity to the discharge, when the fact that they all contribute in an equal degree to the conveyance of the force is proved by the entire series of wires being 'curled' and waved after the discharge, in consequence of the molecular disturbance that has been set up in them during the passage. Professor Melsens also draws attention to the remarkable and interesting circumstance, that in this experiment all the several wires are curled and waved in exactly the same way, each wire having its undulations in the same place, and of the same length, like the nodal arrangements in the vibrations of a stretched string of equal tension and size, but the 'facile princeps,' so far as interest is concerned, of the numerous experiments of Mons. Melsens is, I think, one in which he investigates the relative 'tenacity' of copper and iron when subjected to the disintegrating dispersion of electrical discharges of high tension. The arrangement consists

in placing very fine wire of copper and of iron in the path of a powerful battery discharge. The wires are carefully selected, and adjusted so as to be of precisely the same size and length, and the same discharge is passed through both the copper and the iron. The discharge employed is that of fifteen very large Leyden jars grouped together as a battery. After the discharge has been passed, it is found that the copper wire is dissipated into a trail of black dust, while the iron wire is not even broken across, but is 'beaded' along its entire length by a series of successive protuberances. In this experiment it is clearly demonstrated that copper, which is almost universally accepted as the most reliable metal for powerful electrical discharges, is much more easily disintegrated by their action than iron, notwithstanding the well-known fact that it is more heated by them than copper.

I gladly availed myself, during my agreeable visit to Professor Melsens, of the opportunity to examine very carefully, under his competent guidance, the details of the arrangements which he has adopted for the protection of the fine old Hôtel de Ville of Brussels from the injurious effects of lightning; a work which is now of European celebrity. In this system of defence, iron rods of adequate size are carried out to all the salient projections of the building, and are there protruded into the air in a series of pointed terminals, of which some are grouped around and above the gilded statue of St. Michael, that stands at the top of the central tower of the façade, overlooking the city from its giddy height of 298 feet. There are about 428 points, large and small, and the rods which descend from these points are collected below into a group of eighteen main stems, which are enclosed together in a wooden case, and then made into a continuous metallic mass, by pouring around them, in the interior of the case, molten zinc. On emerging from this connected block beneath, the eighteen rods are sorted out into three parcels, which thus contain six rods each. The first of the series of six is then carried down to a large iron cylinder, sunk ten feet into the moist ground, and firmly soldered to it. The second parcel is soldered in a similar way to one of the large iron pipes of the water supply of the town; and the third parcel is soldered to one of the large iron mains of the gas service of the town. By these admirable expedients a multiple earth contact is finally secured, which, to use Mons. Melsens' own words, comprises not less than twenty millions of kilogrammes, or twenty-two thousand English tons of cast iron tubes. Some of the other public buildings of Brussels have been furnished with lightning conductors upon a similar comprehensive plan, but from conversation with Mons. Melsens, I gleaned that he entertains the bold and magnificent design of getting the entire town some day connected into one continuous system of protection, which shall be to the entire city what the bristling points and multitudinous rods of the Town Hall now are to its gables and pinnacles; a purpose to which the very great compactness of the town obviously lends itself.

The great leading characteristic of this very noble work of Mons. Melsens, which most impresses itself upon the mind of the intelligent and critical observer, who looks down upon the bristling points from a near approach to

St. Michael's footstool, and then examines the subterranean earth contacts, as I did in the pleasant company of the distinguished electrician, is the boldness and uncompromising completeness with which the fundamental ideas of a very ample development of air terminals above, and of earth contacts beneath, is acted upon; an allegiance to correct theory and principle which I cannot but think it would be well for our own electrical engineers to keep more prominently in mind than is sometimes done in our own practice. Within the last few weeks a letter has been sent to me by my friend, the Secretary of the Society of Arts, suggesting that there must be a serious mistake in the printed report of a statement I was said to have made that the French electricians employ 1,196 square yards of earth contact for lightning conductors, because 1,196 square yards are equivalent to nearly a quarter of an acre! And again, it is no uncommon thing to hear even practical electricians in England speak of a lightning rod as being sufficient for its work if its base is but placed as low in the earth as the foundations of the building that is to be protected. It will, however, be at once perceived what an important bearing upon this too confident doctrine Mons. Melsens' demonstrations of the erratic propensity of the impulsive meteor to travel by devious ways when in states of high tension, have. In the assumption that if the lightning be but furnished with a metallic conduit, so far as the vertical extension of a building is concerned, that is all that can be reasonably required, sight is entirely lost of the great practical principle that the erratic tendency of lightning—or, in other words, the high tension of its energy—is enormously increased with each fresh impediment that is offered to its free outflow from the lightning rod below; and that a lightning rod which is entirely efficient and safe when it has a quarter of an acre of an earth contact below, becomes inefficient and eminently dangerous to all objects that are near to it when the quarter of an acre is exchanged for a single square foot of earth contact. In the one case the electrical discharge flows evenly and placidly through the conduit that is provided for its conveyance, without having much more inclination to leap aside from its proper path than the voltaic current has to leave the telegraph wire furnished for its transmission. But in the other case, it bursts through the same conduit with a fitful, disturbed, and ill-conditioned progress, and with an impetuous and fretful impulse to find lateral outlets and devious ways, and to set up, by escape through them, the various unpleasant results which are known under the general designation of the return shock. I have thought it well thus, once again, to return to this particular article of what I hold to be heretical doctrine, on account of the great practical importance which it has upon sound practice in the work of protection from lightning.

I think that, without venturing to make any further demand upon your indulgence and patience, I may hope that I have said enough in these incidental remarks to establish the argument which I have had mainly in view, namely, that there is good open ground, even in this well-worked field of research, for the useful and advantageous employment of our Committee.

REPORT OF THE COUNCIL,

Read at the Annual General Meeting, January 19th, 1876.

THE Council have much pleasure in presenting this Report to the Society, not only because they can show a large amount of work during the past year, but also because they are able to point to a considerable increase in the bulk and quality of the Quarterly Journals, and to a large addition in the number of Fellows elected, without a corresponding decrease from resignations or death.

Mention was made in the Report read at the last Annual Meeting, that for the more efficient conduct of the business of the Society, the Council had appointed a House Committee to consider various matters connected therewith, and to report the results of their deliberations. This Committee has met at least once a month during the past Session, and has been of great assistance to the Council. The Council may also refer to the labours of the Editing Committee of the Quarterly Journals, which have been greater than heretofore, in consequence of the Journals requiring more time and care in preparation than in past years. They also determined to merge the Form Committee in the Station Committee, as the schedules for the use of the Society's observers have been settled, and the services of the former Committee were no longer required. The Council feel that they have received such valuable aid from all these Committees as to justify them in expressing a hope that their successors will continue the system so successfully introduced. In addition to these a Permanent Committee has been appointed on Lightning Conductors, which, it is hoped, will assist, amongst other points, in determining the best forms and materials of conductors for the protection of buildings from lightning.

The members of these Committees are :—

HOUSE COMMITTEE.—The President, three Secretaries, Mr. Brooke, Mr. Eaton, and Mr. Field.

EDITING COMMITTEE.—The President, Mr. Cator, and Mr. Scott.

STATION COMMITTEE.—Mr. Eaton, Mr. Scott, and Mr. Symons.

LIGHTNING ROD COMMITTEE.—The President, (Dr. Mann,) Mr. Brooke, Mr. Preece, Mr. Scott, Mr. Symons, Mr. Falkner of Manchester, Mr. Gray of Limehouse, M. Melsens of Brussels, M. Francisque Michel of Paris, and Professor Zenger of Prague.

During the recess, the room which is used for the Office and Library, at 80 Great George Street, has been thoroughly cleaned, the ceiling whitewashed, a new carpet laid down, and the walls re-papered and varnished. Several further improvements have also been effected, additional chairs provided, and the room made in every respect more comfortable.

Numerous additions have been made to the Library by different Societies, Institutions, and individuals, especially, amongst the latter, by the Astronomer

Royal, the Meteorological Committee, and Mr. Symons. A number of books have been bound during the year, so as to be available for loan to the Fellows.

The Assistant Secretary, Mr. Marriott, has completed the Catalogue of the Library to December 31st, 1875, which is now being printed, and will be issued to the Fellows in the course of a month or so. It has been prepared according to subjects, as it was thought that this form would be most useful, with the addition of a reference index at the end. The Council hope, if any of the Fellows have duplicates, or any meteorological books which they do not require, that they will forward them to the Society.

The observers at the series of stations organised last year have furnished returns since January 1st, 1875. The following report of the inspection, by Mr. Symons, shows what has been done to insure accuracy and uniformity, and is especially valuable, giving a complete description of each station, besides a ground plan, on a uniform scale, of the position of the various instruments. (Plates II.-V.)

Report upon the Stations organised under the direction of the Meteorological Society.

The Meteorological Society, since its incorporation in 1866, has kept constantly before it the establishment of a limited series of Second Order Stations of the highest excellence. The Councils, however, took no action until 1874, because it was felt that it was undesirable to do so until they were prepared to organise the stations perfectly, and to thoroughly discuss the results.

During 1874 a Sub-Committee, appointed by the Council, held frequent meetings to deliberate on the question, to select the observers, to decide upon the requirements which the observers should be called upon to meet, on the instruments to be used, the hours at which they should be read, and generally upon all the points necessary to secure the nearest possible approach to uniformity. All these points having been settled, the following questions were issued to those persons who volunteered to become observers:—

1. What is the amount of open space available for a thermometer-stand and rain gauge? Please give a rough plan, and indicate trees by a ×.

2. Please state which of the following instruments you possess, and place a mark against each one which has been verified, and state if you hold the certificate:—

Standard or Kew pattern barometer.
Dry thermometer.
Wet ,,
Max. ,,
Min. ,,
Sun Max. ,,
Grass Min. ,,
Rain Gauge.

3. Are your thermometers in a louvre-boarded screen erected independently of buildings? If not, would you be willing to obtain, or to employ, such a stand?

4. Do you know accurately the height of your station above Ordnance Datum (mean sea level)? If so, state it, and how ascertained.

5. Would you be willing to fill up the enclosed form with daily observations made at 9 a.m. and 9 p.m. local time? (The Society's large form was enclosed.)

6. In case the Society accepts your offer, and directs one of its officers to call upon you respecting it, kindly state the nearest railway station, and any periods when you are likely to be absent.

The replies having been duly considered and the undesirable stations rejected, it was next decided that every station should be inspected, and the observer personally instructed in the use of all the instruments, &c. so as to secure uniformity of procedure. This course was adopted, although it was well known that several of the newly-selected observers had been making meteorological observations for many years. Still they felt that it was so useless to start any stations except those of the highest quality, that they resolved, regardless to expense, to do every thing in their power to render them as nearly perfect as possible, and they applied to the Council for a total sum of £70; £50 in the year 1874, and £20 in 1875. The Council granted their request, and in order to secure efficiency in the inspection, the following form was employed:—

PRIMARY INSPECTION OF STATIONS.

INSTRUCTIONS AND REPORT.

Observer Station County

Lat: Lon:

Altitude above Ordnance Datum , as ascertained by

Description of station, locality, angle and azimuth of slope of ground.

Draw plan showing position of instruments, trees, and walls, and noting their height.

Mark permanent meridian line.

What means exist for (1) determining and (2) keeping time accurately?

Is locality suitable for an anemometer?

What arrangements have been made for securing continuity of record during illness or absence?

Does observer thoroughly understand decimals, and the mode of taking, recording, and reducing observations?

BAROMETER.

Ascertain that it is (1) vertical, (2) in good light, (3) sheltered from sun, (4) free from air, (5) not liable to sudden changes of temperature, (6) that the vernier is correctly divided.

Reading of thermometer in case , Aneroid No. 1 , No. 2 , No. 3

" " station barometer attached thermometer,

" " do. (by observer) do.

Thermometers.

Refer to and copy certificates.

Place all thermometers, and the case one in a large basin of water of as nearly as may be the temperature of some room not liable to change; after repeatedly stirring the water and allowing an hour to elapse, read as follows:—

(Two sets to be taken not less than 15 minutes apart.)

Time	Case Ther.	Max. No.	Min. No.	Dry. No.	Wet. No.	Grass. No.	Case Ther.
.							
.							

Examine muslin and water supply of wet bulb, and instruct observer as to management in frost.

Examine tops of tubes of minimum thermometers.

Ascertain that the observer reads his thermometers square.

Are the thermometers hung at proper angles?

Is thermometer stand ever in shade? If so, when? and from what? Is it firmly fixed? What is its colour? Does the door open to N? What is the height of the bulbs above grass? Are the thermometers steady?

How is the max. in sun mounted? Is it shaded at any hour? or season?

Is the grass min. fully exposed? Is the grass kept of uniform length? If so, of what length? What is the least distance from the bulb to any surface of gravel, stone or soil?

Rain Gauge.

Construction ; Maker ; Height of top above ground, ft. in.

Diameters ; ; ; . ,, ,, sea level, ft. in.

Equivalents of water. In. ·01 ; ·02 ; ·03 ; ·04 ; ·05 .

Gr. ; ; ; ; .

Elevation and bearing of objects.	Objects	Azimuth	Altitude	Objects	Azimuth	Altitude

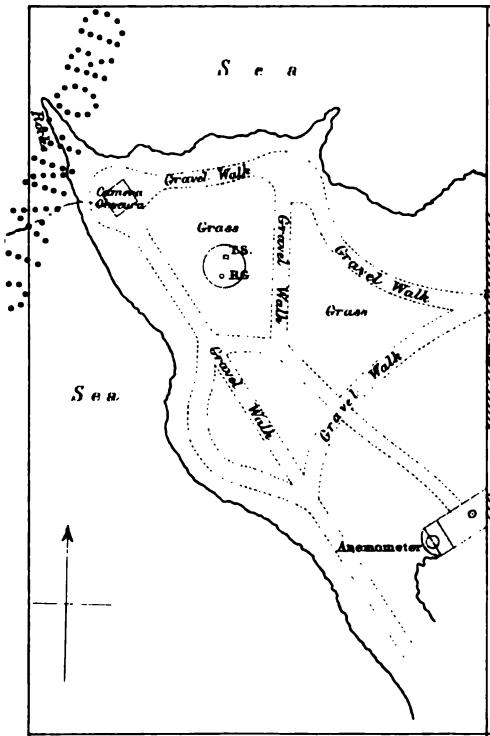
Instruct observer as to measurement of snow.

Go through the Meteorological Society's form, and ascertain that the observer correctly understands every portion of it.

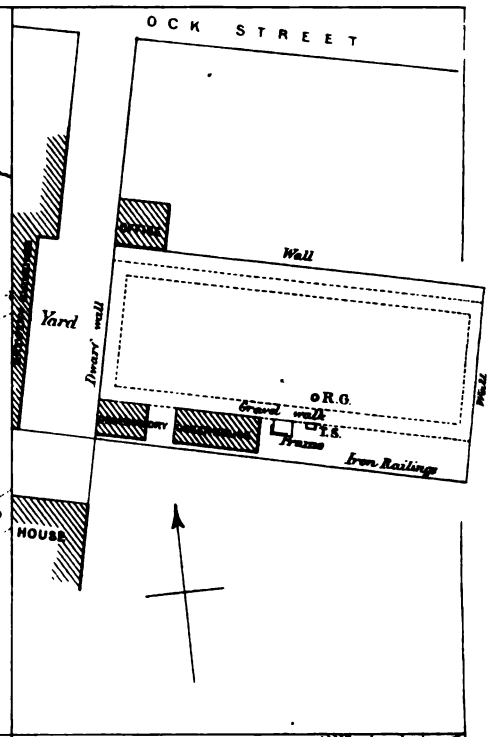
Done this day of 187

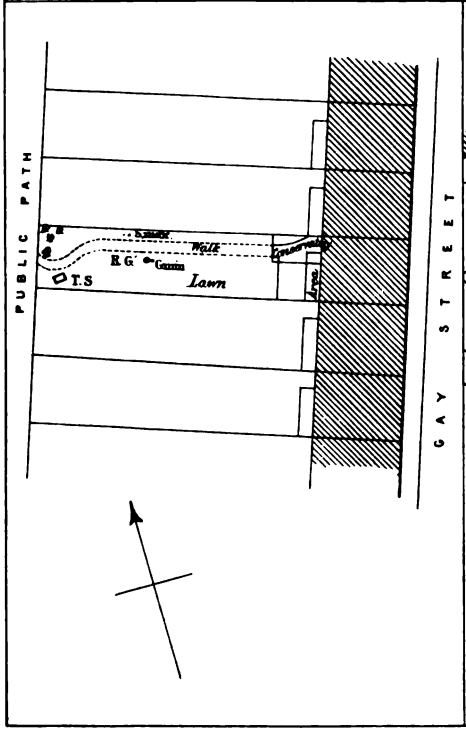
(Signed)

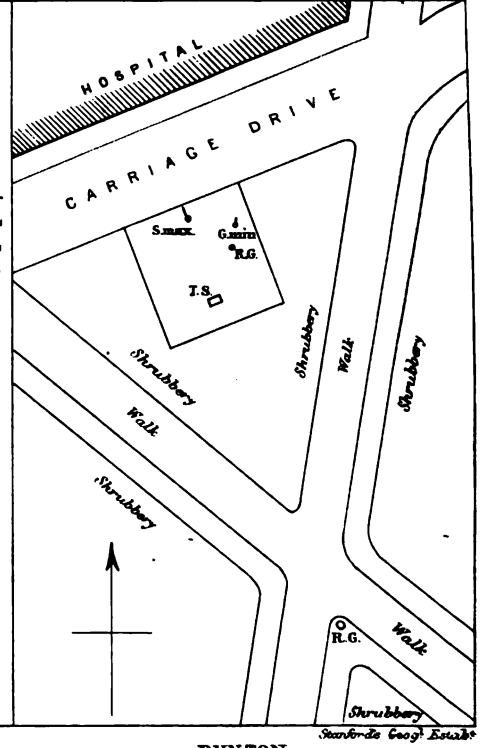
ABERYSTWITH.



ABINGDON.







BATH

BUXTON

Stanford's Geogl Estabt

SCALE.

0 60 120 feet

All the stations in England and Wales have since been visited by Mr. Symons, some of them more than once. All unverified thermometers have been sent to Kew Observatory for comparison, and all verified ones (except those so recently compared that no change of zero point was possible) have been compared. Ground plans of all the stations have been drawn on a uniform scale of an inch to 20ft., meridian lines have been set out, and generally every possible care has been taken to perfect the organization.

With only two exceptions, all the observers had had previous training, and were known to be equal or superior to the average standard of observers; and as they nearly all hold University degrees, it will readily be understood that there was little difficulty in securing thorough efficiency, although, no matter who the observers may be, inspection must be repeated at irregular intervals.

ABERYSTWITH.

The Corporation of this fashionable watering place purchased, in or about 1873, a set of standard meteorological instruments of good quality, and also a Stevenson's thermometer screen. After some correspondence, I called, in August, 1875, upon Mr. Morris Jones, F.M.S., the Medical Officer of Health, to whom the instruments had been intrusted, and by whom they were being observed. I found him most anxious that his observations should be correct, and willing to give any necessary time to the subject; but his observations were of extremely little use, the thermometer-stand and rain-gauge being in an excessively small garden quite overshadowed by his own and adjoining houses. After some consultation, and an examination of other localities, I told him that the best plan would be to apply to the Town Council for a portion of the Castle Grounds. I accordingly wrote to the Town Clerk, and the Council acceded to the request, granting the use of a small space at the extreme west of the grounds, which is protected from molestation. This position is the most exposed which the Society possesses, but I believe that the air which will enter the thermometer screen will be in all respects similar to that which enters all the houses along the mile or so of sea front. The rain-gauge will be placed on the lawn, near the thermometer stand, and will be surrounded by a *cheval de frise*.—This station was revisited November 6th, 1875, and the observer thoroughly instructed.

ABINGDON.

The instruments here are all of the best kind, the barometer, one of Troughton and Simms's, by whom Mr. Belcher's transit and other apparatus had chiefly been supplied. The instruments are in a large garden attached to the brewery, and the position is good. Mr. Belcher, however, finds it impossible to make observations at 9 p.m., and therefore, although in all other respects very suitable, his is ineligible for a station of the second order. The only difficulty being lack of time, it is not impossible that eventually this may be surmounted.

AUDLEY END.

This station is at Lord Braybrooke's seat, near the banks of the Cam, about

twelve miles south of Cambridge. The instruments are, however, the property of, and the observations are taken by, the head-gardener, Mr. Bryan, who has had many years experience as a meteorological observer, and whose previous observations were in nearly all respects so good as to require little change. The barometer had air in the tube, and being of a bad construction I could not expel it, and had to send one of my own down for temporary use. No plan of the present site of the instruments was drawn because Mr. Bryan expected shortly to remove to another part of the estate, where a clear site for the instruments was selected.

Bath.

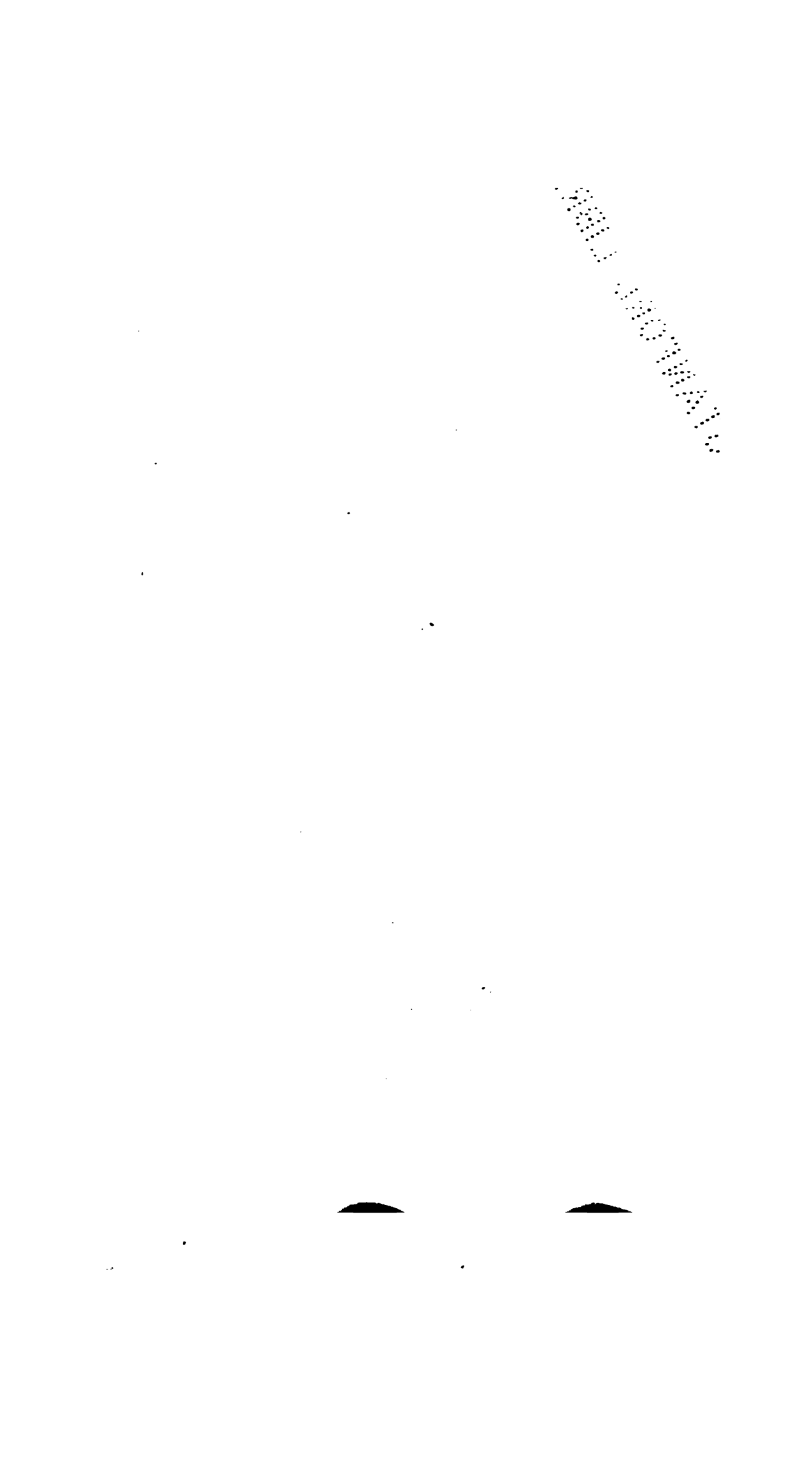
The observer here also has had many years' experience, and the apparatus is all perfect. The observations are made in the garden of Dr. Barter's house, on the west side of Gay-street, near its northern and higher end. The size, &c. of the garden is shown by the accompanying map, and though the house is so lofty that the stand must be in shade in the early morning hours, I think the distance, 150 feet, is such as to prevent the results being sensibly influenced. There is always much difficulty in getting good sites for observations in the heart of cities or towns, and that at Gay-street, Bath, is decidedly better than the average, and, I consider, satisfactory—except, perhaps, for records of wind. Full sets of observations are taken at 9 a.m. and 9 p.m. This station has been inspected twice, viz. in 1874, August 10th; and in 1875, November 2nd.

Brighton.

The Town Council, at the suggestion of the Medical Officer of Health, purchased a set of standard instruments, and they were on the point of being erected when I visited Brighton and called upon Dr. Taaffe. I examined the instruments and found them very good, but the stand to which it was intended to affix the thermometers was so bad in design that I recommended its rejection and the purchase of a Stevenson instead, which was agreed to. I then went to the Steyne Gardens, where it was intended the instruments should be erected, and for which purpose the Town Council had given Dr. Taaffe permission to enclose the necessary space. I selected a site and marked it out, instructed Dr. Taaffe in the reduction of the observations, and left under the impression that regular observations would be made at the proper hours of 9 a.m. and 9 p.m., and that thus Brighton would in all respects set a worthy example to other health resorts. I am, however, sorry, both for the sake of this Society and of Brighton, to be obliged to add that Dr. Taaffe has notified his inability to take 9 p.m. observations, and therefore that for most purposes the records are valueless.

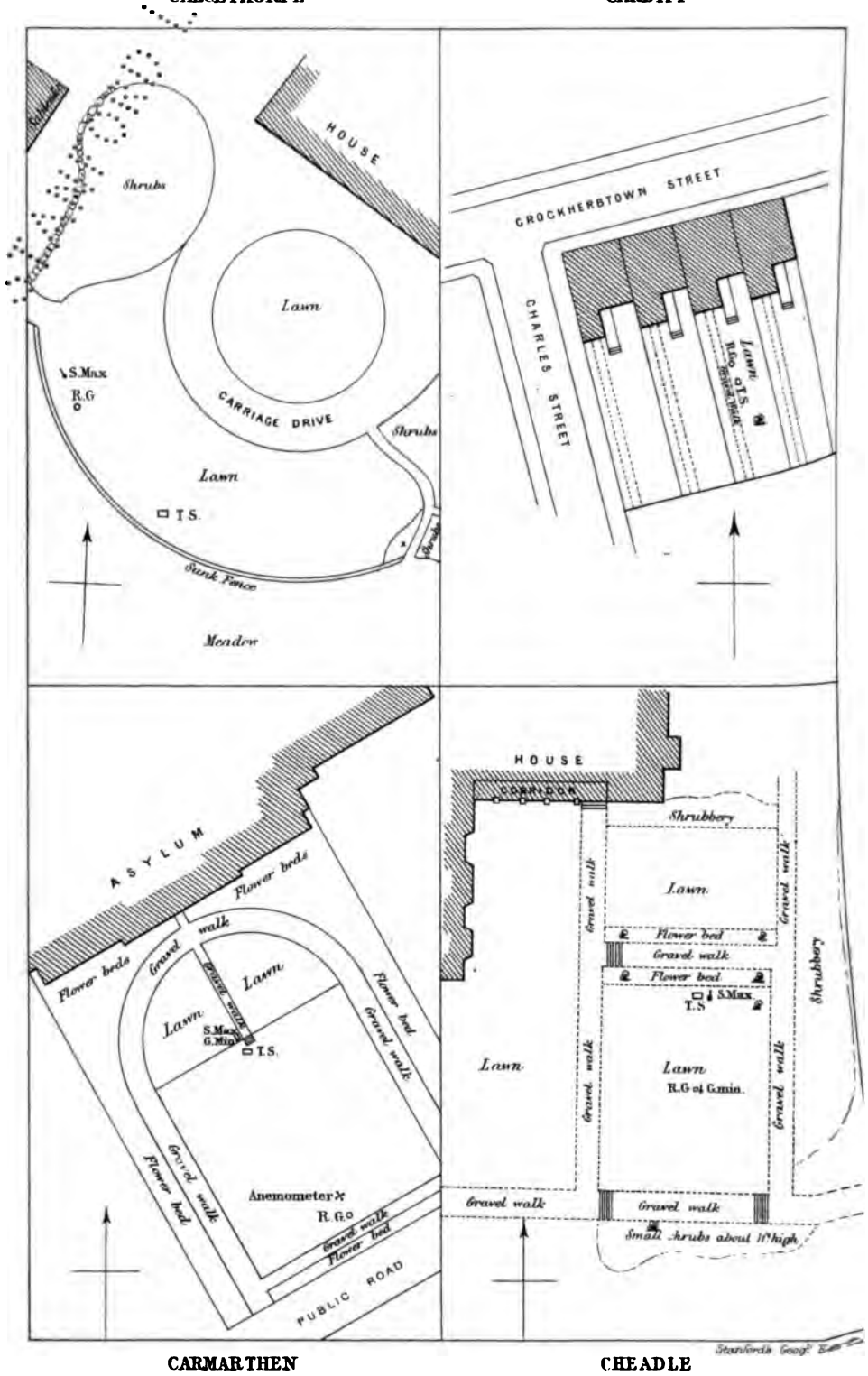
Buxton.

This is one of the best of the Society's stations. The instruments are the property of the Devonshire Hospital and Buxton Bath Charity, and are erected on the Hospital grounds in an extremely good position. The observations are taken by Mr. E. J. Sykes, F.M.S., an observer of considerable experience, and are in all respects perfectly satisfactory.



CALCETHORPE

CARDIFF

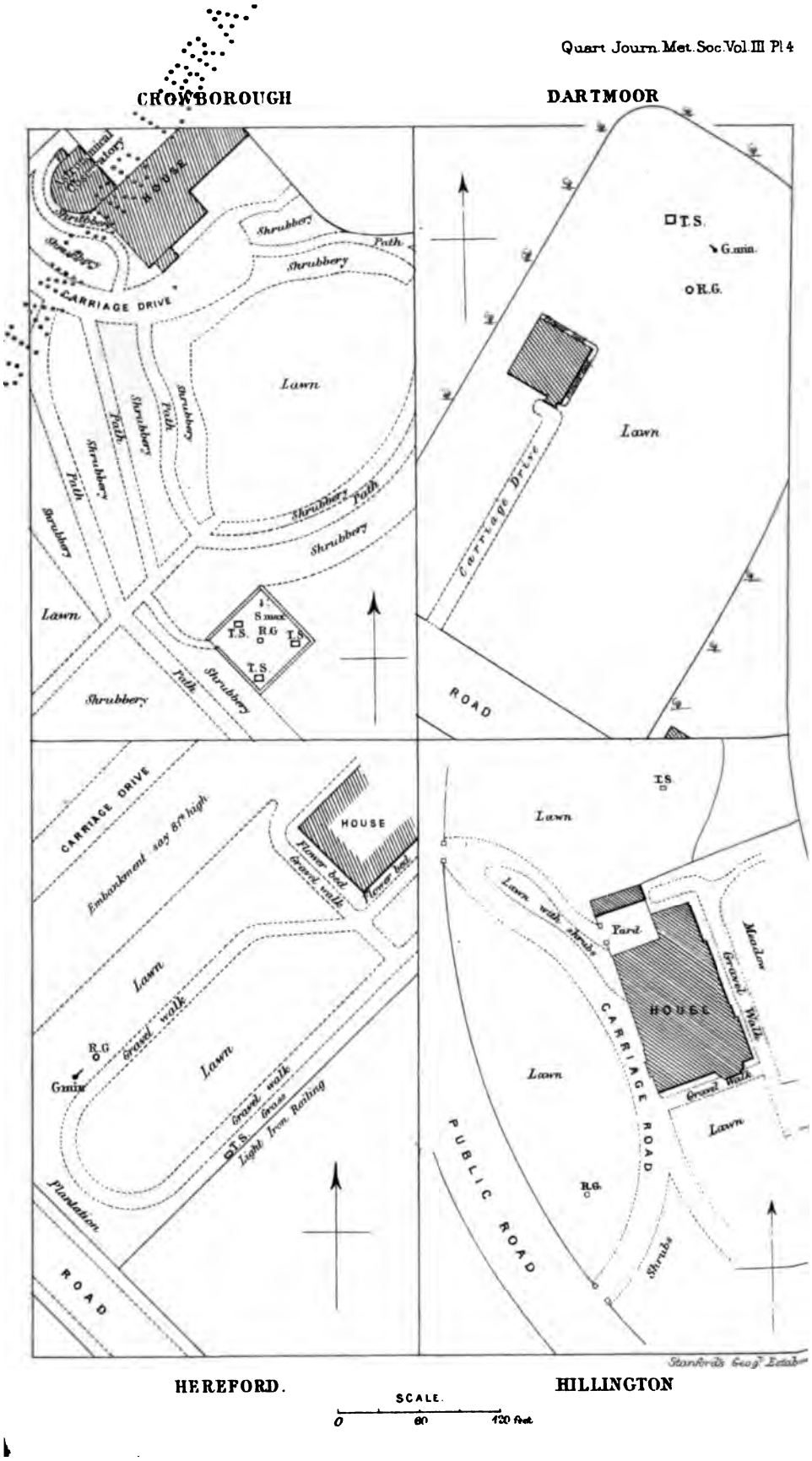


CARMARTHEN

CHEADLE

SCALE.

0 60 120 feet


CROWBOROUGH
DARTMOOR
Magnetical Observatory
HOUSE
Shrubbery
Path
CARRIAGE DRIVE
Lawn
T.S.
G.min.
R.G.
Carriage Drive
ROAD
S.max.
HOUSE
Flower bed
Gravel walk
Embankment say 8ft high
Grass
Light Iron Railing
Plantation
Yard
Meadow
Gravel Walk
Lawn walk
Shrubs
CARRIAGE ROAD
PUBLIC ROAD
Stanford's Geog.l Estab.t
HEREFORD.
HILLINGTON
SCALE.
0
60
120 feet

Calcethorpe, Louth.

station is on high ground about seven miles west of Louth; the of the instruments is perfect, being on a large, nearly treeless, lawn, s only separated from a large grass field by a sunk fence. The ents are all correct, and I believe the observer, Mr. D. Grant Briggs, to be both punctual and accurate.

Cardiff.

V. Adams, C.E., has promised that copies of the observations made kherbtown, Cardiff, shall be forwarded to the Society. I have tested his instruments and found them unusually accurate: the for a town station, is moderately good, but the observations are only 9 a.m., and a Glaisher's thermometer stand is employed.

Carmarthen.

Joint Counties Asylum, otherwise, and originally, called Job's Well, on the brow of a hill about a mile south of the town. The instru- re placed in the private garden or lawn of the principal Medical Dr. Hearder, and the observations are mostly made by him;—in his however, they are taken by others of the resident medical staff. ition is very open and satisfactory, except perhaps as regards the eter, which must be shielded from northerly winds by the building, upwards of 400ft. long.

Cheadle.

trict title of this station should be The Heath House, but Cheadle is eferably as better indicating the locality. The Heath House, in part rounds whereof the instruments are placed, stands on the slope of a very much below its summit. The observations are sometimes taken owner, John Capel Philips, Esq., and sometimes by his bailiff, but d correctly and are good observers. All the instruments are of the d.

Crowborough Beacon Observatory.

is, with one exception, the highest point in Sussex, and commands the whole south-east of England, London, Chatham, Hastings, rne, Brighton, the Isle of Wight, and Windsor, with the intervening lying spread around. The instruments are placed in an enclosed of a nearly level field at some distance from the Observatory, and in ects satisfactorily. The observer, Mr. C. L. Prince, F.R.A.S., &c. is well known as a veteran and able observer, while his work on imate of Uckfield" is an additional testimony to his qualifications.

Dartmoor.

tation here is in the garden of the principal Medical Officer of the prison, Dr. R. E. Power, F.M.S., and the position and exposure of ruments is very satisfactory. The ground is level, nearly 1,400ft. ie sea, and not dominated by any adjacent hills. The observations

are made with regularity generally by Dr. Power, but in his absence by trained subordinates, so that, as at most other stations, absolute continuity of record is ensured. No good barometer was at the station when I called, but one for Dr. Power has recently been verified at Kew.

Hawes.

This station, in the NW of Yorkshire, was not fully organised when I visited it, but the instruments have since been compared (they were of the best quality), a proper thermometer stand has been purchased and erected on a spot in the Vicarage garden selected by myself, I gave the Rev. Dr. Parker due instruction, he has the advantage of residing within a few miles of Rev. F. W. Stow, who is acquainted with all the best methods of observation; and I have, on all these grounds, no doubt that thorough confidence may be placed upon the records of this station.

Hereford.

This is an entirely new station, organised at the County Asylum by the principal Medical Officer, Dr. T. A. Chapman. The asylum is within about two miles of the City, in an open level tract of country. The instruments are placed on the lawn attached to the Medical Officer's residence, and the exposure is perfect. From Dr. Chapman's known skill and energy, there is no doubt that the observations at this station will be in all respects satisfactory.

Hestholm.

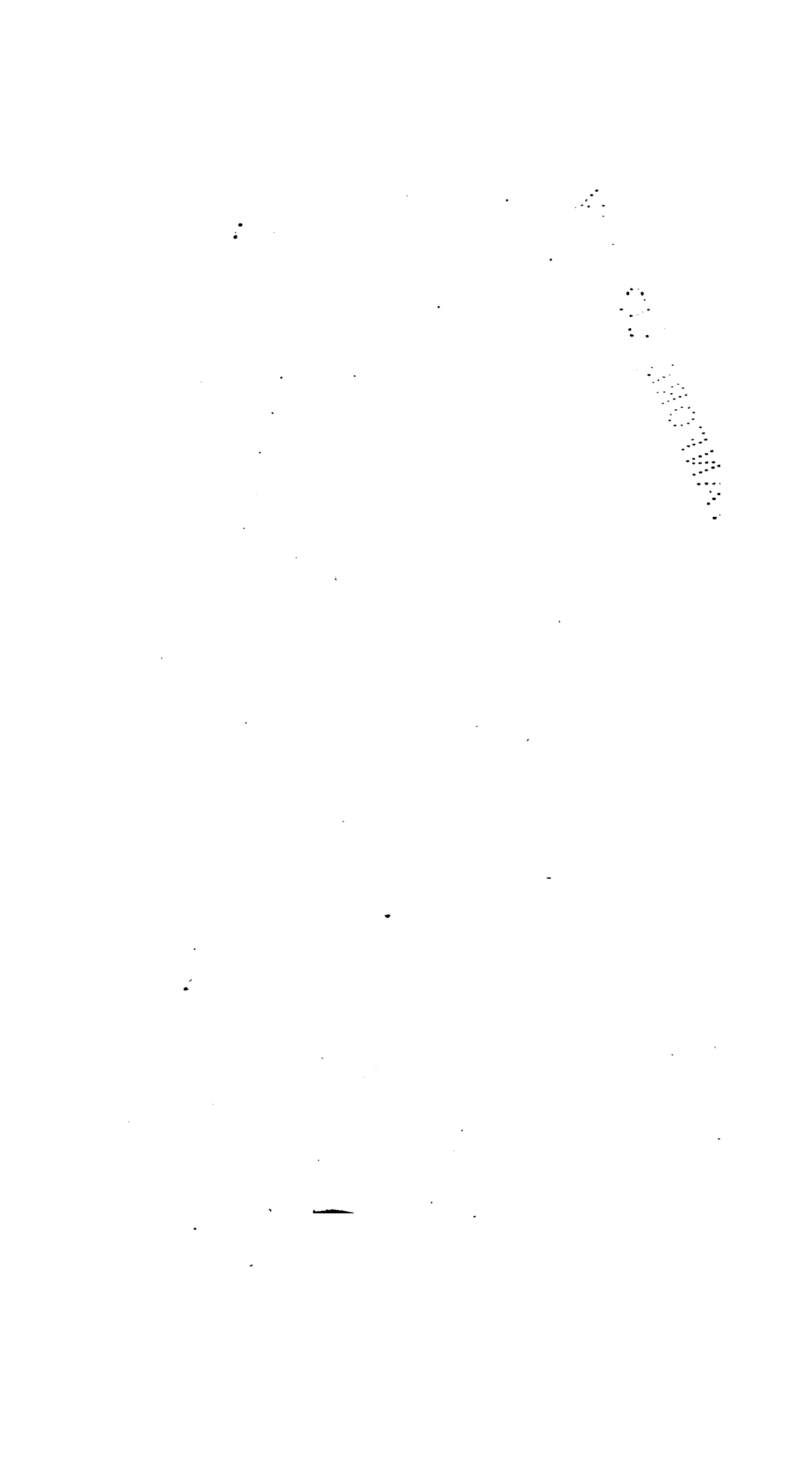
This station, near Aysgarth, and about eight miles east of Hawes, can only be regarded as a temporary one, since the observer, Rev. F. W. Stow, M.A., F.M.S., will shortly remove to a new Rectory at Aysgarth, where the arrangements will be specially adapted to meteorological work. The present station is at the bottom of the valley, close to the River Ure, and only a few feet above the level of its banks. The instruments are perfect, and it is almost needless to refer to Mr. Stow's skill as an observer, but the position is not unexceptionable, and his deputy observer, or rather his second deputy, requires further training. I have no doubt that both these matters will be rectified on his removal to Aysgarth.

Hillington.

This station is distant about 8 miles NE of King's Lynn, in Norfolk, and about 4 miles E of the Wash. The station had originally been a third order one, but the Society needing a good station in the district, the Rev. H. Ffolkes, F.M.S., kindly obtained such standard instruments as were necessary to complete the equipment of his station, and undertook to observe at 9 p.m. as well as at 9 a.m., which he had been in the habit of doing for many years. Although there are woods in the neighbourhood, the station is quite open, and the details are satisfactory.

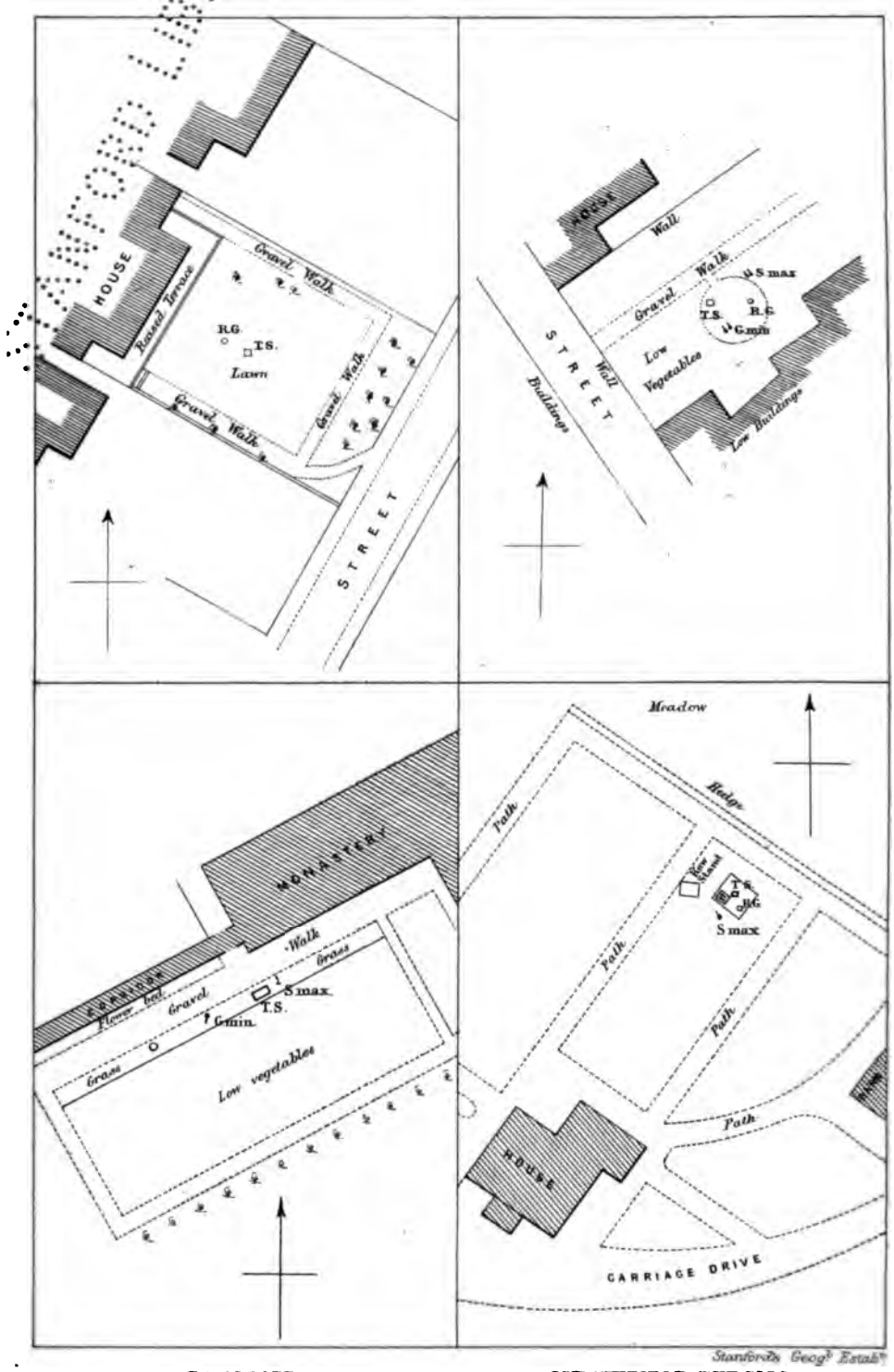
Llandudno.

This is an old-established station, Dr. Nicol, F.M.S., having been observing since 1860. He offered observations to the Society in November 1874, and



LLANDUDNO.

MARLBOROUGH.



Stanford's Geogl Estabt

RAMSGATE.

STRATHFIELD-TURGISS.

SCALE.

0 60 120 feet

the station was inspected November 9th, 1875. The position is not so free from trees as is desirable, and being completely sheltered from northerly winds by the high land of the Great Orme's Head, the results probably differ slightly from those which would be obtained from a station on the lower level isthmus. I cannot, however, see any valid objection to the station, which I regard as a most important one, and fairly representative of the less exposed parts of North Wales. At my suggestion, Dr. Nicol purchased a Stevenson stand, so as to bring his station into conformity with the rest of the Society's stations.

MARLBOROUGH.

There being some difficulty in obtaining 9 p.m. observations at the College, the observer, the Rev. T. A. Preston, M.A., F.M.S., kindly started an entirely fresh set of observations in the garden of his house, The Green, Marlborough. A more open position might be desired, but I do not think that any perceptible difference would be detected. Mr. Preston desired to make, and has, I believe, succeeded in making, his records perfect in all respects. The anemometer and a check rain-gauge are placed in another garden, where it was thought the wind observations would be more accurate.

MELLINGTON HALL.

This very important station in the east of central Wales has been inspected, is provided with perfect instruments, but is not finally and completely organised. The observer, Philip Wright, Esq., F.C.S., F.M.S., is adding to the Hall, and re-arranging the gardens: in so doing, a space will be specially devoted to the meteorological instruments, and a ground plan will then be supplied; meanwhile they remain on the edge of the lawn, in a very good position, quite uninfluenced by buildings or trees. Mr. Wright has had several years' experience as an observer both in England and at Mentone, and is perfectly acquainted with the duties; his head gardener is also trained, and reported to be a competent substitute; all calculations are, however, made by Mr. Wright.

PENTYRCH.

This station is in a gorge, or rather just at the south end of a gorge in the Taff valley, about six miles north-west of Cardiff. The instruments are in a small front garden well exposed to the south, but much sheltered in the north. The observer having found it impracticable to take 9 p.m. observations, and objecting to the pattern of stand adopted, it is unnecessary to enter into further details.

RAMSGATE.

This is a well-placed station at the outskirts of the town of Ramsgate, the instruments being placed in the garden of St. Augustine's Monastery, and the observations made by the Fathers in residence. The instruments were good, and Father Quelch, who was in charge when I inspected the station, appeared to thoroughly understand the work and be an able observer.

STRATHFIELD TURGISS.

This station is so well-known from the experimental work carried on there,

Observer. *Station.* *County.*	*Latitude.* *Longitude.* *Altitude.*	*Description of Station.*
M. Jones, Esq., L.R.C.P., F.M.S., Castle Ground, Aberystwith, Cardigan.	52° 24′ N. 4° 6′ W.	Ground slopes gently from east and west ments, drops about 30 feet abruptly Very exposed position.
W. Belcher, Esq., Ock Street, Abingdon, Berkshire.	51° 40 N. 1° 17′ W.	In garden attached to brewery, quite level.
Mr. J. Bryan, The Gardens, Audley End, Saffron Walden, Essex.	52° 1′ 20″ N. 0° 13′ 20″ E. 164 feet.	Square grass plot 20 feet by 20 feet, ground The instruments are at present in anot the grounds, about 100 yards distant.
C. S. Barter, Esq., M.B., Gay Street, Bath, Somerset.	51° 23′ 0″ N. 2° 23′ 50″ W. 145 feet.	Garden of house on west side of Gay Street i and upper part of the City.
R. P. B. Taaffe, Esq., M.D., The Steyne Gardens, Brighton, Sussex.	50° 50′ N. 0° 8′ W. 30 feet.	Near the southern extremity of the Steyne G protected from the full force of the south-west sea winds by the building sea. They, however, only rise to a si being some hundred feet distant.
E. J. Sykes, Esq., F.R.A.S., F.M.S., Devonshire Hospital, Buxton, Derby.	53° 16′ N. 1° 55′ W. 1,000 feet.	
D. G. Briggs, Esq., F.M.S., Calcethorpe Manor, Louth, Lincoln.	53° 23′ N. 0° 7′ W. 382 feet.	High ground, very open, and nearly level.
W. Adams, Esq., C.E., Crockherbtown, Cardiff, Glamorgan.	51° 28′ N. 3° 10′ W. 41 feet.	Garden in rear of house. Ground level.
G. J. Hearder, Esq., M.D., The Asylum, Carmarthen, Carmarthen.	51° 52′ N. 4° 18′ W. 195 feet.	Medical Officer's garden, ground nearly leve the summit of ground surrounded about 150 feet lower.
J. C. Philips, Esq., The Heath House, Cheadle, Stafford.	52° 28′ N. 1° 57′ W. 644 feet.	
C. L. Prince, Esq., F.R.A.S., F.M.S., Crowborough Beacon Observatory, Tunbridge Wells, Sussex.	51° 3′ 14″ N. 0° 9′ 30″ E. 828 feet.	On one of the highest points in the sou England, the observatory commands t almost the whole of Sussex and mucl and Surrey. The instruments are soutl the Observatory, but at such a distan height does not affect the results.
R. E. Power, Esq., L.R.C.P., F.M.S., Dartmoor Prison, Devon.	50° 33′ 2″ N. 3° 59′ 6″ W. 1,400 feet.	Immediately south-east of the Prison Bu very high and nearly flat land, not slo than 10° or 15°—lowest towards north-e

... of determining time.	*Suitability of locality for an Anemometer.*	*Arrangements for recording during Observer's absence.*	*Exposure of Thermometer Stand.*	*Solar Radiation. Terrestrial Radiation.*
Signal in n and Town t.	Good site available.	Borough Surveyor is quite competent.	Exposure thoroughly good.	No instrument. No instrument.
Instrument Observatory t.	No suitable position.	No arrangements can be made at present.	Exposure thoroughly good.	No instrument. No instrument.
lignal Chroter and clock at the	No suitable position, tall trees in most parts of the grounds.	Assistant Observer trained.	Exposure thoroughly good.	No instrument. Good instrument, well placed.
Signal and ns public s.	No suitable position, except on buildings.	An Assistant Observer will be trained.	Almost always in shade from trees.	Mounted on wires from wall. Well placed.
ns public s in the ity.	No very suitable position; there is an anemometer on the old pier ¼ mile distant.		Probably shaded in the afternoon, in the extreme depth of winter, by distant houses.	Instruments not yet mounted.
l Clock.	Only suitable position on a building where there is a Robinson's.		In shade after 7 p.m. from Hospital buildings.	The instruments will be well mounted and properlyplaced
tained from Post Office ept by segood clocks.	The instrument at present in use would be in a good position if raised to get clear of trees.	One Assistant Obsever is trained, and another will be as far as possible.	Probably in shade for a few minutes, about 7.30 a.m. in November.	Good instruments, properly mounted and well exposed.
Signal and ver's watch.	Locality unsuitable for an anemometer.	Two Assistant Observers trained.	Slightly in shade in winter from a tree.	No instruments.
tained from Office at arthen and by obserwatch and l English t.	No suitable position; the Asylum shelters more or less all the surrounding ground. One is, however, at work on the spot shown in the plan.	Assistant Medical Officer always present during Dr. Hearder's absence.	Will be thoroughly exposed.	Will be properly mounted and well exposed. Good instruments well placed.
t compariwith railclock at well.	No suitable position.	Assistant Observer trained.	Thoroughly exposed.	Good instruments properly mounted and well exposed.
Instrument Observatory	An Anemometer at work in a suitable position.			
h Station by, and clock carefully regulated y belonging son.	An Anemometer could be well placed in the vicinity.	There are three trained Observers in the establishment besides Dr. Power.	Thoroughly exposed.	Not yet in position. Good instrument fully exposed.

Observer. Station. County.	*Latitude. Longitude. Altitude.*	*Description of Station.*
Rev. J. Dunne Parker, LL.D., F.M.S., Hawes Vicarage, Yorkshire.	54° 18′ 8″ N. 2° 11′ 19″ W. 806 feet.	In level garden of Vicarage, and south the from all injurious shelter.
T. A. Chapman, Esq., M.D., The Asylum, Hereford, Hereford.	52° 5′ N. 2° 45′ W. 279 feet.	Large level lawn, south-west of the Asylum.
Rev. F. W. Stow, M.A., F.M.S., Hestholm, Aysgarth, Yorkshire.	54° 18′ N. 1° 58′ W. 474 feet.	On the south bank of the Ure, at its junctior Bishopsdale beck. Bishopsdale is wide for at least 2 miles to the south-west of th but Wensleydale is here very narrow, th scending in a succession of waterfalls a more than 100 feet in the mile next a station; its course is from west to east. south-east the ground is level for nearly and then rises in a succession of limest and ridges to the height of 1,800 fe position is only temporary.
Rev. H. Ffolkes, F.M.S., Hillington Rectory, Lynn, Norfolk.	52° 47′ 42″ N. 0° 33′ 23″ E. 108 feet.	Rectory Garden; ground nearly level, as is, surrounding district. No trees to affect
J. Nicol, Esq, M.D., F.M.S., Llandudno, Carnarvon.	53° 20′ N. 3° 50′ W. 100 feet.	Garden in front of house slightly sloping south-east. Sheltered from north and high hills.
Rev. T. A. Preston, M.A., F.M.S., Marlborough, Wilts.	51° 25′ N. 1° 43′ W. 474 feet.	Kitchen garden quite level, surrounded by low on south and south-east, and by somewh ones on north, but none rise 25°, and o point exceed 20°. The elevation of the gr is under 10°.
P. Wright, Esq., F.C.S., F.M.S., Mellington Hall, Churchstoke, Montgomery.	52° 31′ N. 3° 5′ W.	On lawn, at sufficient distance from the Hall t uninfluenced thereby.
F. G. Evans, Esq., F.M.S., Pentyrch, Glamorgan.	51° 31′ N. 3° 15′ W. 100 feet.	Ground level, but rising very abruptly 360 f north-west.
Rev. T. Hugh Quelch, O.S B., St. Augustine's Monastery, Ramsgate, Kent.	51° 20′ N. 1° 25′ E. 108 feet.	In Monastery Grounds, good position.
Rev. C. H. Griffith, F.M.S., Strathfield Turgiss, Hampshire.	51° 20′ 23″ N. 1° 2′ 30″ W. 196 feet.	Rectory Garden; the grounds are free from l except quite at the outskirts, and are lev

of deter-ng time.	*Suitability of locality for an Anemometer.*	*Arrangements for recording during Observer's absence.*	*Exposure of Ther. mometer Stand.*	*Solar Radiation. Terrestrial Radiation.*
	Yes; but no instrument yet fixed.	Assistant trained.	Good.	Complete set properly mounted.
1 Observa- r mile dis- Time Sig- nd Asylum .	Locality suitable for an Anemometer, if mounted high.	Arrangements will be made as soon as possible.	Thoroughly exposed.	Instrument will be properly mounted and exposed. Well exposed.
ph Office at urn and ex- it Austrian ator.	No suitable position for instrument.	One Assistant Observer trained, and another will be.	In shade up to 8.30 a.m. in the winter half of the year, but then the sun has often not risen over the hills.	Properly mounted, but in shade before 8 a.m. and after 4 p.m. Good instrument, almost fully exposed.
Signal at Office in e, and ob- r's watch.	Yes, if placed on a high pole.	Servant trained.	Well exposed.	No instruments.
Signal and rver's watch	Locality not suitable.	Assistant Observer trained.	Will be thoroughly exposed.	No instruments
ignal at Post and nu- us public s.	Locality is unsuitable; but one is placed in a garden near.	Assistant Observer trained.	Will be thoroughly exposed.	Will be good instruments properly mounted and exposed.
us good s, Time Sig- at Church- , and fre- t communi- n with rail- tations.	Locality suitable, if the instrument was mounted high, and distant from the Hall.	Head Gardener trained.	Will be thoroughly exposed.	Will be properly mounted and well exposed. Well exposed.
ich mean obtained ardiff, local taken there- , and kept Observer's h.	Locality not suitable for an Anemometer.	Several Assistant Observers trained, but Observer rarely absent.	Will be thoroughly exposed.	
ery Clock.	No suitable position, except on buildings.		Thoroughly exposed.	Properly mounted and placed.
oscope and onometer tch by us.	Doubtful. The grounds are, however, more free from trees than most parts of the district.	One Assistant Observer is thoroughly trained.	Thoroughly exposed.	Good instruments, well mounted and exposed.

that it is hardly necessary to say more than that, for the purposes of the Society, a small grass lawn has been laid down in a perfectly level and open part of the garden, where all the instruments are placed in perfect order. Owing to the temporary illness of the Rev. C. H. Griffith, F.M.S., this station has not been visited since September, 1874, but there is no reason to doubt its perfect efficiency.

The Council have voted an additional sum of £20, making altogether £70, for the organisation and inspection of these stations. The best thanks of the Society are due to Mr. Symons for the great pains he has taken in inspecting the stations, in drawing plans of each, and in assisting at all times in every matter connected with this work.

The monthly abstracts of these stations will be printed annually in the Quarterly Journal, and it is proposed that the daily records of one or more shall appear in full.

In the last Report, the Council gave the details of an arrangement with the Meteorological Office, by which they agreed to furnish, for a consideration, copies of observations from a definite number of stations. Copies have been supplied to the Meteorological Office of the detailed observations made at the following stations, viz.:—

Buxton, Derbyshire.	Dartmoor, Devon.
Calcethorpe, Lincolnshire.	Hawes, Yorkshire.
Carmarthen, Carmarthenshire.	Strathfield Turgiss, Hants.

Monthly values are furnished for the following places, viz.:—

Audley End, Essex.	Hillington, Norfolk.
Bath, Somerset.	Llandudno, Carnarvon.
Cheadle, Staffordshire.	Marlborough, Wilts.
Crowborough Beacon, Sussex.	

The Council would here refer in terms of satisfaction to the friendly footing subsisting between the Society and the Meteorological Office. They feel that the Society is especially indebted to the kind offices of their Foreign Secretary, Mr. Scott, for aid in establishing a relationship which, while not interfering with the free action of either body, is likely to prove of advantage to both.

Observations are also received on the small forms from:—

Aberdeen	Rev. A. Beverly, LL.D.
Aghalee, Lurgan, County Down	Lancelot Turtle.
Barlaston, Staffordshire	William Scott.
Bolton, Lancashire	William Musgrave.
Burnley, ,,	William B. Bryan, Assoc. Inst. C.E.
Crewkerne, Somerset	F. J. Sparks.
Forest Hill, Kent	Edwin E. Glyde.
Hadleigh, Suffolk	J. T. Muriel, M.R.C.S.
Mansfield, Nottingham	Richard Tyrer, B.A.
Teignmouth, Devon	William C. Lake, M.D.
,, ,,	G. W. Ormerod, M.A., F.G.S.

Wimbledon, Surrey	Henry Colborne, M.R.C.S.
Cannes, France	Frederick Green.
Rossinière, Switzerland	Col. M. F. Ward.
St. John's, Newfoundland	John Delaney, Postmaster General.

Various instructions, which form part of a Report of the Station Committee, and which have been forwarded to most of the above-named observers, are reproduced here, as they may be useful to other Fellows of the Society.

1.—The limits of error in the reduction of barometer readings to be 0·005 inch; in the calculation of the dew point, 0·°3, and elastic force of vapour, 0·005 inch.

2.—The maximum and minimum must always correspond with the 9 p.m. dry bulb reading of the previous day; that is to say, the highest and lowest readings are to be entered as the maximum and minimum for each 24 hours ending 9 p.m.

3.—When the air is saturated with moisture, and the wet bulb reads higher than the dry, they are both to be considered equal at the dry bulb reading.

4.—Readings of the minimum on grass, which are higher than the minimum in air, are to be left as they are, but noted to draw attention to the fact.

5.—Readings which are found to be erroneous, and which the observer cannot explain, are to be altered in the office, but not by the observer, and entered in brackets.

6.—When observations have been omitted, the blanks are to be filled up by interpolation, but no mean is to be taken of any column, if more than three days' observations have been interpolated in that column.

7.—Any thing above 0·005 inch to constitute a day of rain.

8.—Observations which are taken only once a day (9 a.m.) are not to be published.

9.—An observation which has not been taken punctually is to be altered, if necessary, at the discretion of the computer in the office, and entered in brackets.

As the experience gained by the Assistant Secretary in the service of the Society has enabled him to discover several sources of error, from an intercomparison of the returns from the Society's stations, it may be as well to state them here, in the hope that they may be of service to the observers generally.

Barometer.—Erroneous readings of 1 inch or 0·5 inch are readily detected, and, in some cases, of 0·1 inch.

To avoid mistakes of this kind, the observer would do well to re-examine the instrument after taking the other observations; he should also notice whether the top of the mercury in the tube is convex or flat, that is, whether rising or falling, and then refer to the previous reading, to see in what direction the change has been progressing.

The observations of deputies, in the absence of the regular observer, should always be noted. Where any suspicion attaches to the observations thus

taken, no attempt should be made to correct them, but the attention of the computer at the office of the Society should be directed to the exceptionable record.

To read the barometer correctly is easy enough, with ordinary care; but to reduce the reading for temperature, index error, capillarity, and to sea level, is comparatively troublesome. When the elevation of the instrument above the level of the sea has been ascertained with accuracy for any station, a table for this purpose, based on the 'Instructions in the use of Meteorological Instruments,' by Mr. R. H. Scott, is prepared by the Assistant Secretary, from a plan devised by the Rev. F. W. Stow, and a copy is forwarded to the observer, should he desire it.

Thermometers.—It sometimes happens, in damp weather, that the indication of the dry bulb is lower than that of the wet bulb thermometer, to the extent of a few tenths of a degree. When this is the case, the dry bulb thermometer should be carefully wiped several minutes before the readings are taken.

Mistakes of 5° or 10° in reading the thermometers are not infrequent. If the dry bulb is read wrongly, the wet bulb is almost sure to be so also. In this way it sometimes happens that the recorded maximum or minimum are either lower or higher than the readings of the dry and wet bulb thermometers for the same day, although, in the latter case, the discrepancy may be occasionally accounted for by the sluggishness of the alcohol thermometer, especially should the minimum temperature occur about the time of observation of the other instruments.

The Joint Committee of Delegates from this and other Societies, appointed to draft complete instructions for the observation and registration of Natural Periodical Phenomena, have finished their labours, and sent in their Report, which was read before the Society at the February Meeting.* A code of rules, entitled 'Instructions for the Observation of Phenological Phenomena,' has been prepared and published. Observations from a number of Fellows, as well as from several ladies and a few gentlemen, have been received; and the Rev. T. A. Preston, M.A., has kindly undertaken to discuss the first year's observations. The following is his Report:—

Observations have been sent in from the following places:—

	Lat.	Lon.	Observer.	Months.
1 Plymouth	50°22′N.	4°10′W.	T. A. Briggs, Esq.	April.
2 Yeovil	50 56 N.	2 39 W.	Rev. J. Sowerby	Jan. & Mar.
3 Strathfield Turgiss	51 20 N.	1 0 W.	Rev. C. H. Griffith	Jan. to Dec.
4 Marlborough	51 26 N.	1 43 W.	Rev. T. A. Preston	Jan. to Dec.
5 Hastings	50 51 N.	0 52 E.	A. W. Langdon, Esq.	April.
6 East Farleigh	51 16 N.		Miss M. L. Case	Apl. to July
7 Maidstone	51 17 N.	0 32 E.	W. H. Bensted, Esq.	April.
8 Isleworth	51 25 N.	0 20 W.	Miss E. A. Ormerod	Apl. to Oct.

* 'Quarterly Journal,' Vol. II. page 332.

	Lat.	Lon.	Observer.	Months.
9 Walthamstow	51 38 N.	0 0	W. R. Birt, Esq.	March.
10 Cardington	52 7 N.	0 25 W.	Mr. J. McLaren	Apl. to Oct.
11 Great Cotes	53 34 N.	0 5 W.	John Cordeaux, Esq.	Mar. to Dec.
12 Killingholme	53 37 N.	0 10 W.	Rev. J. Byron	Mar. to Jne.
13 Alderley Edge	53 17 N.	2 12 W.	A. W. Waters, Esq.	Apl. to Aug.
14 Dalkeith	55 55 N.	3 3 W.	Henry Dobbie, Esq.	Apl. to Aug.
15 Weybridge	51 32 N.	0 25 W.	A. R. Graham, Esq.	October
16 Bishop's Frome	52 10 N.		Rev. H. L. Graham	Oct. to Dec.
17 Watford	51 39 N.	0 24 W.	J. Hopkinson, Esq.	Dec.

Nos. 1, 2, 5, 7, 9, 15, 16, 17 have not been included in the Table of Botanical notices, as the returns for these places extend over so short a time; 12 has also been omitted, as the returns are almost entirely ornithological. The Botanical observations furnished by the Observers at these places are enumerated subsequently in a different form. For the sake of shortening the Table, those species of which very few observations have been taken are also omitted in the Table, and inserted at the end.

In the Table, the actual dates sent in are inserted; one asterisk (*) indicates that the plant was "in flower," and two asterisks (**) that it was "in bloom." Perhaps, in deducing results from the Table, a week may be deducted from the recorded date for one asterisk, and a fortnight for two, in order to get the approximate date of first flowering. A ? after a date indicates that the word "by" was entered in the returns, and for the date entered, two, three, or four days have been subtracted from the date recorded, according to the opinion of the Observer, *e.g.* "by April 27, three or four days" would be entered April 23 ?

1 Plymouth	20	*Vicia sepium*	April 18.
	46	*Hieracium Pilosella*	April 29.
	60	*Ajuga reptans*	April 26.
2 Yeovil.....	4	CALTHA PALUSTRIS	March 19.
	37	TUSSILAGO FARFARA	March 13 ?
	63	*Mercurialis perennis*	January 30.
	64	*Ulmus Montana*	March 10.
5 Hastings.....	12	*Stellaria Holostea*	April 20.
	52	*Veronica Chamædrys*	April 20.
9 Walthamstow	2	RANUNCULUS FICARIA	April 4.
	65	*Salix caprea*	March 23.
	70	*Galanthus nivalis*	March 7.
12 Killingholme	2	RANUNCULUS FICARIA	March 10.
	7	*Cardamine pratensis*	April 30.
	22	PRUNUS SPINOSA	April 22 ?
	26	*Rosa canina*	June 6.
	61	PRIMULA VERIS	April 24.
16 Bishop's Frome ...	12	*Stellaria Holostea*	April 18.

Species, of which very few notices have been taken:—

29 *Angelica Sylvestris* ..... Strathfield Turgiss August 8.

No.	Plant.	Strathfield Turgiss (3).	Marlborough (4).	East Farleigh (6).	Isleworth (8).	Cardington (10).	Great Cotes (11).	Alderley Edge (13).	Dalkeith (14).
1	Anemone Nemorosa	March 28*	March 17	....	....	April 4	April 4	April 17	April 3
2	Ranunculus ficaria	Feb. 16*	Feb. 1	....	April 19**	April 5	March 30	March 31 (?)	....
3	*Ranunculus acris*	....	March 31	May 13**	....	May 11	May 24	May 5	....
4	Caltha palustris	....	March 27	April 20	....	April 25	April 12	April 17	....
5	*Papaver Rhœas*	June 1**	May 21	....	June 22**	May 24	....	June 19 (?)	....
6	*Cardamine hirsuta*	....	Jan. 25	....	May 2*	April 5	....	April 19	June 1**
7	*Cardamine pratensis*	April 21*	April 26	April 6	....	April 25	April 24	....	May 8
8	*Draba verna*	....	Feb. 4 – Mar. 26	....	April 16**	April 5	....	....	....
9	*Viola odorata*	Sheltered Jan. 23	March 13	....	....	April 6**	March 9	....	April 5**
10	*Polygala vulgaris*	April 12**	May 10	May 26	....	....	.. .	May 6	....
11	*Lychnis Flos-cuculi*	May 18**	May 20 (?)	May 17	....	May 23	May 9	June 18	....
12	*Stellaria Holostea*	April 22*	May 3**	April 26	....	May 7	....	April 17	May 3
13	Malva Sylvestris	June 13	June 5	June 4**	June 22**	June 5	June 3	July 16*	June 12 – July 1
14	*Hypericum tretapterum*	July 11	July 6 (?)	....	....	June 14	. ..	....	July 14
15	*Hypericum pulchrum*	July 11	June 29	....	....	June 14	....	July 18	....
16	Geranium Robertianum	May 4	May 3*	May 6	....	May 20	May 13	....	May 11
17	Trifolium repens	May 2	May 15	....	....	June 9	....	....	....
18	*Lotus corniculatus*	May 17	May 16	May 25**	July 6**	June 6	....	May 15	..
19	*Vicia Cracca*	June 20	June 5	June 8	....	....	June 9	June 21	June 5
20	*Vicia sepium*	May 18	May 3*	May 8*	....	....	....	May 6	....
21	*Lathyrus pratensis*	....	May 27	June 6	July 4*	June 15**	June 10	June 24	June 2
22	Prunus spinosa	April 6*	April 12	April 21*	April 16	April 16	April 25**	....	....
23	*Spiræa Ulmaria*	June 23	June 17	June 17	Aug. 13	June 22	June 25*	July 7	June 27
24	*Potentilla anserina*	....	May 13	May 23	....	June 7	....	....	May 5 – June 2
25	*Potentilla Fragariastrum*	Feb. 3*	March 5	....	April 27**	....	....	April 2	....
26	*Rosa canina*	....	May 30	June 3	June 9 (?)	June 9	June 6	June 18 (?)	May 27 – June 3
27	*Epilobium hirsutum*	....	July 18	June 28	July 25	....	July 12	July 13 (?)	July 9
28	*Epilobium montanum*	June 10	June 17	....	. ..	June 24	....	June 21	June 7
30	*Anthriscus sylvestris*	....	Mar. 14, 29 – May 3**	....	....	May 5	....	May 9	....
32	*Galium Aparine*	....	May 3	May 7	July 9**	May 13	....	..	June

		Turgiss (3).	(4).	(6).	(8).	(10).	(11).	Edge (13).	(14).
33	*Galium verum*	June 26	June 24	....	July 28**	June 25	....	....	June 27
35	*Scabiosa succisa*	July 30	....	....	....	....	July 28*	July 26	July 7
36	*Petasites vulgaris*	....	March 4	Before April 22	....	....	April 6**	April 24 (?) †	April 16
37	TUSSILAGO FARFARA	....	March 10	....	April 16*	April 6**	March 15	March 30	April 10**
38	ACHILLEA MILLEFOLIUM	....	June 6	June 26	July 4*	....	....	June 26	June 22
39	*Chrysanthemum Leucanthemum*	May 14	May 16	May 16	May 31**	May 20	....	....	June 15**
40	*Artemisia vulgaris*	Aug. 9	....	....	....	....		Aug. 6	July 4**
41	*Senecio Jacobæa*	June 21	June 19	....	....	....	July 12	July 1	....
42	CENTAUREA NIGRA	June 18	June 7	June 7	....	June 7	....	July 11	June 29 July 2
43	*Carduus lanceolatus*	....	July 19	....	....	Aug. 1, 14	....	July 29	July 6
44	*Carduus arvensis*	June 19	July 1	June 27*	July 6*	June 26	June 30	July 11	July 12
45	*Sonchus arvensis*	Aug. 1	July 10	....	....	June 18	....	Aug. 5	Aug. 8
47	CAMPANULA ROTUNDIFOLIA	July 19	July 11	July 10	....	....	July 7	July 6	....
49	CONVOLVULUS SEPIUM	July 6	July 10	June 18	July 31	....	July 7	July 31	July 8
52	*Veronica Chamædrys*	May 1**	May 3**	May 4	May 2*	May 9	....	May 7 (?)	May 9
54	*Mentha aquatica*	July 26		....	Aug. 9	....	..	....	Aug. 13
55	*Thymus serpyllum*	June 4	June 3	....	July 31**	....	....	....	June 13
56	*Prunella vulgaris*	June 29	June 12	June 22 (?) earlier	....	June 4**	....	June 15 (?)	May 12* July 20
57	*Nepeta Glechoma*	....	May 3	....	....	April 27	April 14		April 7
58	*Galeopsis Tetrahit*	July 17	June 29	....	....	....	....	July 23 (?)	July 25
59	*Stachys sylvatica*	June 18	June 9	....	....	June 13	....	June 19 (?)	June 20 July 16
60	*Ajuga reptans*	May 3	May 10	May 11**	May 24*	May 8	....	May 9	....
61	PRIMULA VERIS	April 8*	May 3**	April 19	April 30*	Showing flower April 10	April 12	....	April 12
62	*Plantago lanceolata*	....	May 3*	....	....	May 3	....	April 28	April 21
63	*Mercurialis perennis*	April 1	March 5	....	....	April 6**	....	April 2	April 1*
65	*Salix caprea*	March 20**	March 14	....	....	April 8*	March 31**	April 2	April 2**
66	*Corylus Avellana*	Jan. 5	Jan. 18	....	....	....	....	....	....
67	*Orchis maculata*	May 26	June 3	....	....	..	May 6	June 14 (?)	May 19
68	*Iris Pseud-acorus*	June 3	May 30	June 1	June 8	....	June 11 (?)	June 16 (?)	....
69	*Narcissus Pseudo-narcissus*	April 1**	March 23	....	....	April 6**	....	....	April 4
71	*Endymion nutans*	April 24	April 8	April 25	....	....	April 24	May 1	May 10

† At Stockport.

81	HEDERA HELIX.....	Marlborough	October 12 ?
		Isleworth	October 22 *
84	*Dipsacus sylvestris*	Strathfield Turgiss	August 24.
		Isleworth	August 21.
46	*Hieracium Pilosella*.....	Marlborough	May 16.
		Cardington	May 28.
48	*Gentiana campestris*.....	Strathfield Turgiss	August 30.
		Dalkeith	July 18.
50	*Symphytum officinale*	Marlborough	May 3 *
		Dalkeith	May 6.
51	*Pedicularis sylvatica*	Marlborough	May 16.
58	*Veronica hederifolia*.....	Marlborough	March 10 *
		Cardington	April 23 **
		Dalkeith	April 4.
64	*Ulmus montana*	Strathfield Turgiss	March 11. (? this species)
		Marlborough	March 9.
		Cardington	April 9 **
70	*Galanthus nivalis*.....	Strathfield Turgiss	January 16 **
		Marlborough	January 15.

INSECTS.

72	*Melolontha vulgaris*	Strathfield Turgiss	May 20	First seen
		Isleworth	May 14	,,
		Cardington	May 12	,,
78	*Rhizotrogus solstitialis* ...	Isleworth	July 12	
		Cardington	June 30	
74	*Apis mellifica*.....	Strathfield Turgiss	March 14	Flying.
		Isleworth	April 14	Solitary till this date.
		Walthamstow	March 30	First seen.
75	*Pieris Brassicæ*	Marlborough	April 16	
		Isleworth	April 25	? this species. June 2, plentiful.
		Great Cotes	May 8	
		Dalkeith	May 1	
76	*Pieris Rapæ*	Plymouth	April 17	First seen.
		Strathfield Turgiss	April 16	,,
		Marlborough	April 30	,,
		Isleworth	April 30	First caught.
		Cardington	May 25	First seen.
		Great Cotes.	April 29	First appeared
77	*Epinephile Janira*.....	Strathfield Turgiss	June 8	First seen.
		Isleworth	June 29	Plentiful.
		Great Cotes	June 6	

INSECTS—*continued.*

Bibio Marci	Strathfield Turgiss	April 15	Caught two.
	Isleworth	May 22	A few on rose bushes.
Trichocera hiemalis	Strathfield Turgiss	January 4	Abundant
Gonopteryx rhamni	Strathfield Turgiss	Feb. 15, Mch. 10, Ap. 7	
	Marlborough	March 16	

BIRDS.

Strix aluco	No records.		
(Brown Owl)			
Muscicapa grisola	2	May 25, first seen	
(Flycatcher)	4	May 11 ,,	May 31 (5 eggs)
	10	May 10 ,,	
	11	May 22 ,,	
	12	May 9	
Turdus musicus	1	April 5 (eggs)	
(Song Thrush)	2	Feb. 2, song	Feb. 16, song
	4	Feb. 3, song	April 3 (3 eggs)
	10	April 12, first hatched	
	11	March 3, paired	
	14	Nov. 6, song	
	17	Dec. 25, song	
Turdus pilaris..... ..	4	March 22, seen	May 13, one seen.
(Fieldfare)	10	April 15, in flocks	
	11	May 3, last seen	
		Oct. 28, first flight	
		Nov. 15, large flocks	
	16	Oct. 23, one bird flying N.	
		Oct. 24, 5 or 6 on trees	
Daulias luscinia	2	April 21, first heard	
(Nightingale)	6	April 20 ,,	
	7	April 17, first seen	
	8	Apl. 30 – May 1, first heard	
	10	April 26, first heard	
Saxicola Œnanthe	4	April 6, first seen	
(Wheatear)	7	April 6 ,,	
	11	April 12 ,, (10 days late)	
	16	April 14	
Phylloscopus trochilus...	4	April 6, song	May 18 (6 eggs)
(Willow Wren)	11	April 19, first heard	
	12	Apl. 25, seen & heard	

BIRDS—*continued.*

87 *Phylloscopus collybita* ... (Chiff-chaff)	2	Apl. 5, song at Heckfield	
	4	April 8, seen	May 24 (7 eggs)
	11	April 15, first heard	
	16	March 30	
88 *Alauda arvensis* ..... (Skylark)	2	March 9, song	
	4	Jan. 31, Feb. 16, song May 19, young	
	11	Sep. 24, many arrived	
	17	Dec. 25, song	
89 *Fringilla cœlebs* ..... (Chaffinch)	2	Feb. 12, song	
	4	Feb. 15 ,,	May 6 (2 eggs)
	8	April 14, seen	
	11	March 8, paired	
	16	Nov. 9, song	
90 *Corvus frugilegus* ..... (Rook)	2	Feb. 10, pairing	
	3	March 3, building	
	4	March 6, ,,	March 20 (eggs)
	8	April 12, ,,	
	10	April 13, first hatched May 14, Rook shooting	
	12	Mar. 4, building, usual date; Mar. 2, 1873, Feb. 26, 1874.	
91 *Cuculus canorus* ..... (Cuckoo)	1	April 20, first heard	
	2	April 18, ,,	
	4	May 3 ,,	
	5	April 17, ,,	Reported from Heathfield
	6	April 18, ,,	
	7	April 20, first seen	
	8	April 29, first heard June 8, note changed	
	10	April 19, first heard	
	11	April 24, ,, June 25, last heard	
	12	April 23, first heard	
	13	April 21, ,,	
	14	April 28, ,,	
	16	April 19	
92 *Hirundo rustica* ..... (Swallow)	1	April 13, first seen	
	2	April 17, ,, Aug. 14, congregating	
	4	May 19, building	June 19, young

BIRDS—*continued.*

92 *Hirundo rustica* ..... (Swallow)	5	by April 24, seen earlier	
	6	May 8, several seen for first time	
	7	April 15, first seen	
	8	May 5, ,,	Sep. 10, congregating; gone, Oct. 16
	10	April 19, ,,	
	11	April 16, ,, Aug. 22, large flocks were seen after Oct. 18	
	12	April 19, seen *here*; seen in the neighbourhood April 16	
	13	April 14, first seen	
	14	April 24, ,,	
	15	Oct. 17, flock flying S.W.	
	16	April 19	
93 *Cypselus apus* ..... (Swift)	2	May 15, flying	
	4	May 7, seen	
	6	May 10, first seen	
	11	May 5, one seen	
	12	May 19, seen	
	16	May 5	
94 *Columba Turtur* (Turtle Dove)	2	May 8, first seen	
	4	May 11, ,,	May 16 (2 eggs)
	10	June 12, first found sitting	
95 *Perdix cinerea*..... (Partridge)	2	July 10, young first seen	
	4	Feb. 15, paired	March 27 (eggs)
	10	Apl. 27, first eggs seen June 11, hatched off	
	11	June 29, young hatched off	
96 *Scolopax rusticola* ..... (Woodcock)	10	Oct. 22, first seen	
	11	Oct. 15, first flight arrived	
97 Frog Spawn	2	March 17, first seen	
	4	March 25, about this date	
	8	June 27, young frogs	
	9	March 25, spawn	
	10	April 28, frogs leaving spawn	

BIRDS—*continued*.

92	Frog Spawn	11 March 9, spawn first observed 12 March 19, spawn; first observed Feb. 28, 1872, Mar. 25, 1873, Mar. 18, 1874 13 April 1, spawn 14 May 22, ,,

Under any circumstances, but very few reliable results could be obtained from the first year's observations; but in the present case the observations in many instances are not so exact as could be wished, because the observers have not fully understood the object of taking them. It may be as well, therefore, to say a few words (1) as to the *objects* aimed at; (2) how the present observations fail; and (3) to deduce such general results as can be obtained from the observations sent in.

(1.) As to the *objects* aimed at:—

Such notices as these are of great use to the botanist, as they enable him to understand the *constitution* of the different plants, and may possibly lead to very important results; but the Meteorological Society is not so directly concerned with botany, and therefore their object in collecting these observations is to see how far the nature of the seasons can be inferred from the state of vegetation, or the appearance or habits of insects and birds, and how far, therefore, certain plants, insects or birds can be taken as guides for the agriculturist. As an example, some persons do not attempt to cut their hay till the common grass, *Phleum pratense*, comes into flower. Now at Marlborough, from the year 1865 to 1875, this species has always flowered between the 10th and 14th of June, except in 1865, when it flowered on the 4th June, and in 1871 on the 1st June [in 1868 the plant escaped notice.] Upon referring to Mr. Glaisher's quarterly report for these two years, he states in 1865 "haymaking proceeded satisfactorily," and in 1871 "haymaking had been frequently interrupted by rain and much hay had been spoiled," the previous months as a rule having been unusually cold. Clearly, therefore, no very great reliance can be placed on this plant as regards an indication of the season, but as it comes into flower after all the other common grasses grown for hay, it is a sign that the sooner the grass is cut after the flowering of the *Phleum* the better the hay will be, as the grass has then reached its best state.

But besides this class of objects (which surely are of immense use, and well worth the trouble of procuring), several results of a more purely *scientific* value may be obtained, as the intimate relation of the climate of one district to that of another, and in this case, more especially, accuracy and exactitude of observations are particularly necessary; and here many of the observations furnished singularly fail. In order to get a comparison between two plants,

some definite time must be selected. It has been suggested that every plant requires a certain amount of heat imparted to it in order to bring it to its flowering stage—which will be when the first flower opens. If the season is cold, a longer time will be occupied in imparting the necessary amount of heat, and *vice versâ*; consequently this period of *first flowering* may be taken as the time for comparison. Defoliation, ripening of seed, &c. are also useful, but observers differ so much as to *when* a tree is in leaf or defoliated, that for *scientific* purposes it is hardly possible at present to depend upon these data, though very useful in a general way. In the case of plants, therefore, the date of FIRST *flowering* is the most important to observe, and at present is all that is required. Great care must, however, be taken here; and this leads to the *second* point.

(2.) How some of the present observations fail.

They fail in two particulars,—their incompleteness and their indefiniteness. Of the 17 sets of observations sent in

6 were for only 1 month.
2 ,, ,, 2 months.
1 ,, ,, 3 ,,
1 ,, ,, 4 ,,

Then again, of these 17 three only begin in January, three in March, 8 in April, 2 in October, and 1 in December.

No doubt the great reason for this is that observers had to be found, and consequently many could not begin before April; but it must be borne in mind, that for these observations to be of any real practical utility, they must be continued *regularly* throughout the year.

As regards the *indefiniteness* of the records, this can only be remedied by care and experience, and in alluding to it now, it is done solely with the aim of securing an improvement, not from any wish to find fault.

The *general* results seem satisfactory, though inaccuracies appear to have been made occasionally, and unfortunately the request for specimens has not been attended to, consequently there is no means of checking apparently doubtful records. It is also very probable that some of the dates will have to be modified, as it is generally found that first years' observations are often too late, and that experience will enable observers to find things earlier than they otherwise would do. Another point which it would be as well to correct is, the vague manner in which entries are made—"in fl.," "in bloom," "coming into fl.," are used by some observers indiscriminately (though not so by all). Sometimes merely the number of the species is put down, at others both number and name; again, the same flower is noted by some more than once, the number merely being entered, but without any reason stated why the second entry was made. Others, again, state "very common," causing a doubt as to whether the species is common in the neighbourhood, or whether it is commonly in flower. Such entries, though possibly easily comprehended by the observer at the time, create difficulties which are not easily solved, and which sometimes even cannot be cleared up. It would greatly facilitate the comparison of observations, as well as secure a very

desirable uniformity in the returns, if observers would kindly attend to the following suggestions :—

1.—To secure *certainty* about the species alluded to, insert both the number on the list and the name of the species. (The forms will be altered as soon as the present stock is exhausted.)

2.—*As a rule*, merely insert the date of first flowering (in the case of plants).

3.—Where extra-early specimens are registered, state the reason why so inserted.

4.—If the date of first flowering has escaped notice, the state of the species when first observed to be described by the following:—"by" when apparently in flower only a day or two, "in fl." when the species is fairly in flower, *i.e.* generally open, and "in bloom," if fully out everywhere.

5.—Any remarks about the species (as an unusually long or short period of coming into flower generally) may also be entered.

The notices of birds and insects must remain as at present, notes of first singing, building or hatching being entered if observed, for future comparison.

(8.) The localities from which returns up to October have been sent may be grouped into the following six sets :—

A. Plymouth, Yeovil, Strathfield Turgiss, and Marlborough.
B. Hastings, East Farleigh, Maidstone, Isleworth, and Walthamstow.
C. Cardington.
D. Great Cotes and Killingholme.
E. Alderley Edge.
F. Dalkeith.

Fortunately for each of these six groups, fairly complete observations are sent in from at least one locality, and hence a few general results may be obtained. Taking, then, these six groups, *as a rule* plants come into flower first in the SW of England (A), then in the SE (B), the maritime district E (N. Lincolnshire) is earlier than the more inland one D (Bedfordshire), whilst E (near Manchester) on the west is more backward than D on the east of England. As for F (Dalkeith) it is very irregular, being generally but little more backward than and frequently as forward as the two southern districts A and B. But more accurate results cannot yet be obtained, from the vagueness of the entries. When a plant is said to be "in bloom" at two places, it is impossible to compare them, and a very short glance at the Tables will show the difficulty of coming to any definite conclusion in some cases; but notwithstanding this the Tables will repay perusal. The most curious fact perhaps is, that some plants come into flower *first* at Dalkeith, and then in regular order going southward till their latest appearance is in the south, at Strathfield Turgiss; such plants are the Ground Ivy (*Nepeta glechoma*) in April, the Devil's Bit (*Scabiosa succisa*), the Spear Thistle (*Carduus lanceolatus*), the Hair Bell (*Campanula rotundifolia*) in July, and the Mugwort (*Artemisia vulgaris*) in August.

Finally it may be remarked, that the large number of plants has certainly not proved disadvantageous. Had we kept to the 14 special ones, we should

have missed some facts which may prove of use hereafter; and it does not seem to have caused any extra trouble to the observers. There are numerous other notices kindly supplied by some observers, especially from Strathfield Turgiss, which will be extremely useful, but are not entered in this present Report, as it would make it needlessly lengthy.

The Schedules of Observations are kept in the Society's Library for future reference.

In May last, a letter was received from the Rev. F. W. Stow, requesting the Council to allow the Assistant Secretary to continue the discussion of the Solar Radiation Observations which he had commenced some years ago, but was unable to go on with. The Council, while acceding to this request, were of opinion that a better comparison would be afforded between bright bulb thermometers *in vacuo*, and black bulb thermometers *in vacuo*, both mounted alike, instead of the maximum thermometer in the shade. They accordingly solicited the assistance of several observers, which was at once given, nearly all providing instruments at their own cost. Observations on this plan are taken at

Calcethorpe	D. Grant Briggs, F.M.S.
Camden Square	G. J. Symons, F.M.S.
Carmarthen	G. J. Hearder, M.D.
Cheadle	J. C. Philips.
Crowborough Beacon	C. L. Prince, F.R.A.S., F.M.S.
Halifax	Louis J. Crossley, F.M.S.
Hawes	Rev. J. D. Parker, LL.D., F.M.S.
Hestholm	Rev. F. W. Stow, M.A., F.M.S.
Marlborough	Rev. T. A. Preston, M.A., F.M.S.
Southampton	R. C. Hankinson.
Strathfield Turgiss	Rev. C. H. Griffith, F.M.S.

It will be remembered that, in May last, the President, (Dr. Mann,) read an elaborate paper on 'Some practical points connected with the construction of Lightning Conductors.'* The subject was again brought before the Council at the June Meeting, when, after some deliberation, they appointed a Permanent Lightning Rod Committee, to investigate and record accidents from lightning, to inquire into the principles involved in the protection of buildings, to diffuse exact information regarding the best form and arrangement for Lightning Conductors, and to consider all phenomena of atmospheric electricity. This Committee is not composed of Members of Council only, but includes several of the Fellows, and some well-known electricians, as will be found on referring to the list of names on the Committee.

In April last, a letter was received from the Imperial Academy of Sciences, Vienna, asking the Society to turn its attention to the subject of the decrease

* 'Quarterly Journal,' Vol. II. page 417.

in the amount of water in springs, streams, and rivers, and to contribute, as far as may be possible, towards the discovery of a remedy for checking such serious calamities as are likely to arise therefrom; and also to assist the Academy in obtaining observations of the water level in flowing streams during a series of years. The Council considered this an important matter, and, accordingly, appointed a Committee, consisting of Messrs. Eaton, Field, Scott, and Symons, to investigate the subject.

The Papers read before the Society during the past Session, although perhaps not very numerous, have been both interesting and valuable.

The following instruments were exhibited at the Meetings:—

Wild's Pressure Anemometer. By R. H. Scott, F.R.S.

A New Barograph. By M. Louis Redier.

Several Thermographs. By Wildman Whitehouse, F.R.A.S.

Lowe's Graphic Hygrometer. By R. H. Scott, F.R.S.

A Continuous Self-registering Thermometer. By W. Harrison Cripps.

A Self-regulating Atmometer. By S. H. Miller, F.R.A.S.

Lamont's Atmometer. By R. H. Scott, F.R.S.

A complete Set of Instruments, with Thermometer Screen, &c., as used at the Russian Meteorological Stations. By R. H. Scott, F.R.S.

On the completion of Vol. I. of the Quarterly Journal, the Council changed the Printers and Publishers, as they believed that the printing could be done much cheaper elsewhere. They have now much pleasure in stating that this measure has been fully justified, as the work has been equally as well done, and the cost of Vol. II., which has just been completed, consisting of 468 pages, has been only £207, while that of Vol. I., containing 276 pages, amounted to £227.

The large additional work cast upon the Assistant Secretary by the comparison and examination of the returns furnished by the observers, necessitated the appointment of a youth to assist in the general work of the Society and the extension of the hours of attendance at the office from 10 a.m. to 5 p.m. These arrangements have fully answered the expectations of the Council, and must be continued as long as the present amount of work has to be performed.

It is satisfactory to be able to announce a considerable increase in the number of Fellows. This is, in a great measure, due to an invitation, soliciting their co-operation and support, which was sent by the Council to the recently appointed Medical Officers of Health, who are practically interested in Meteorology. Nineteen have joined the Society, and several offered to take observations.

Two additions have also been made to the list of Honorary Members during the year, viz.:—Dr. Julius Hann, of Vienna, and M. Emilien Renou, of Paris.

The accompanying Table shows the total number of Fellows now on the rolls to be 358, of which 82 are Life, 258 Ordinary, and 18 Honorary Members, showing a net increase during the year of 32.

	Fellows.			Totals.
	Life.	Ordinary.	Honorary.	
1874, December 31 (corrected numbers)	78	232	16	326
Since elected	+5	+39	+ 2	+46
Deceased	−1	− 1	...	− 2
Retired	...	− 8	...	− 8
Defaulters	...	− 5	...	− 5
Reinstated	...	+ 1	...	+ 1
1875, December 31 ...	82	258	18	358

The average attendance at the Meetings is very considerably in excess of that in former years: for in 1871 the average was 25; in 1872, 26; in 1873, 34; in 1874, 42; and in the past year 42; so that the Council can fairly congratulate the Society on the great progress it has made, as well as on the greater estimation in which it is held by the scientific public.

In consequence of Messrs. Martin & Co., the Bankers of the Society, having their place of business at an inconvenient distance from the Office of the Society, it was determined, in the early part of the year, to remove the account to the Western Branch of the Bank of England, in Burlington Gardens, which has been done, so that all future subscriptions may be sent there, or to the Assistant Secretary, at the option of the sender.

The balance sheets, as presented by the Auditors, are very satisfactory, as they show, not only that nearly £1,100 are invested, but that a sum of £105 10s. will accrue to the Society during the year 1876, from subscriptions overdue, and from payments by the Meteorological Office for copies of returns from six stations, and of monthly summaries from seven stations; whilst, on the other side, our only liabilities are included in the words, "to sundry creditors, £4." The receipts for the year are equally satisfactory, as they are as much as £420; whilst the expenditure, including £139 19s. for salaries, £129 13s. for printing and stationery, £78 for office expenses, £47 for outlay in connection with the observing stations, and other smaller items, amount to nearly £400, leaving a balance in favour of the Society amounting to £20. It is true that £60 was received for Life Composition fees, which according to the rules of the Society must be invested, but the £105 due above the subscriptions of the present year will more than provide for that sum. As the Catalogue of the Library, List of Fellows, and other similar items, will increase the expenditure during the forthcoming year, the Council trust that this Report will not lessen either their or your efforts to render the Society more flourishing than it is even at the present time.

APPEN-

Abstract of Receipts and Expenditure

Receipts.

1875.		£	s.	d.	£	s.	d.
Jan. 1.	Balance from last year..	....			16	13	8
April	Dividend on £200 New 3 per Cents.	2	19	6			
June	Do. £800 M. S. & L. R. 4½ Debenture Stock	17	17	0			
Oct.	Do. £200 New 3 per Cents.	2	19	6			
Dec.	Do. £800 M. S. & L. R. 4½ Debenture Stock	17	17	0			
					41	13	0
June	Meteorological Office.—Copies of Returns from Six Stations on Form A, January to June				15	0	0
Dec.	Subscriptions for 1873	5	1	0			
	Do. for 1874	24	11	0			
	Do. for 1875	208	1	6			
	Do. for 1876	4	0	0			
	Entrance Fees	45	4	0			
	Life Composition Fees.....	60	0	0			
					346	17	6
Dec.	Sale of Publications. By Assistant Secretary	15	19	5			
	Do. By Williams and Strahan	0	8	4			
					16	7	9
					£436	11	11

DIX I.

for the Year ending December 31st, 1875.

Expenditure.

1875.	£	s.	d.	£	s.	d.
ournal—						
Printing Nos. 13—16	77	4	6			
Illustrations	11	9	0			
Authors' Copies	8	3	6			
Registrar-General's Reports	6	4	0			
				103	1	0
rinting, &c.—						
General Printing	14	4	0			
Stationery	6	15	9			
Books and book-binding	5	12	5			
				26	12	2
alaries—						
Assistant Secretary	125	0	0			
Computer	14	19	0			
				139	19	0
ffice Expenses, &c.—						
Rent and Housekeeper	28	17	0			
Repairs, Furniture and Coals	12	11	3			
Postage and Receipt Stamps	23	16	2			
Parcels and Petty Expenses	4	9	1			
Refreshments at Meetings	8	12	0			
				78	5	6
bservations—						
Inspection of Stations	20	0	0			
Printing Forms and Observation Books	13	7	6			
Phenological Phenomena.—Reports, Instructions, and Forms	9	17	6			
Bright-bulb Thermometers *in vacuo*	3	15	0			
				47	0	0
iscellaneous—						
Subscriptions overpaid returned	5	0	0			
Bankers' Commission on Country Cheques	0	2	1			
				5	2	1
				399	19	9
Balance at Bank of England, December 31st, 1875	29	12	5			
Balance in hands of Assistant Secretary	6	19	9			
				36	12	2
				£436	11	11

HENRY PERIGAL, *Treasurer.*

Examined, compared with the Vouchers, and found correct, January 11th, 1876.

G. M. WHIPPLE,
E. G. ALDRIDGE, } *Auditors.*

APPENDIX I.—*Continued.*

Abstract of Assets and Liabilities for the year ending December 31st, 1875.

Liabilities.

	£	s.	d.
To Sundry Creditors	4	0	0
,, Excess* of Assets over Liabilities	1259	2	2
	£1263	2	2

Assets.

	£	s.	d.	£	s.	d.
By Society's Money invested in New 3 per Cents., £200 at 94	188	0	0			
,, Society's Money invested in M. S. and L. R. 4½ Debenture Stock, £800 at 111	888	0	0			
				1076	0	0
,, Subscriptions of the year uncollected	48	10	0			
,, Do. former years unpaid	21	10	0			
,, Entrance Fees unpaid	3	0	0			
,, Meteorological Office.—Copies of returns from six stations on Form A, July to December	15	0	0			
,, Ditto. Monthly summaries from seven stations on Form B for the year 1875	17	10	0			
				105	10	0
,, Furniture, Fittings, &c.	25	0	0			
,, Instruments	20	0	0			
				45	0	0
,, Cash in hands of Bank of England, December 31st, 1875	29	12	5			
,, Cash in hands of Assistant Secretary	6	19	9			
				36	12	2
				£1263	2	2

G. M. WHIPPLE,
E. G. ALDRIDGE, } *Auditors.*

* This Excess is exclusive of the Value of the Library and Stock of Publications.

The Society has to deplore the loss by death of two of its Fellows, viz.:—

Robert Savignac Stedman, M.R.C.S., elected into the Society, November 27th, 1855.

Theodore Henry Maine Walrond, November 19th, 1873.

Robert Savignac Stedman, M.R.C.S., was born in 1827, and was educated at Tunbridge School. He entered Guy's Hospital in 1845, where he gained the esteem of all who knew him. He became a medical practitioner at Sharnbrook, Bedford, where he practised till the time of his death, which occurred on the 30th of December, 1874.

He was very popular in the neighbourhood, and his kindness, intelligence, and devotion, gained for him many warm friends. Mr. Stedman was appointed Health Officer of the northern half of the Bedford Union in 1873, and immediately devoted himself to his new labours in the most thorough manner, providing himself with all the new appliances required for exercising his arduous duties with great energy. He published an exhaustive report, remembered by the writer of this notice as a most complete and carefully arranged summary of every thing bearing on the sanitary condition of the district.

Mr. Stedman was one of those country medical practitioners who, possessing a good knowledge of many departments of science, amid active and incessant professional engagements, manage to find time for scientific study and investigation; and he was an excellent representative of that large class of highly intelligent and well-educated thoughtful doctors for which our country is eminently distinguished; men who, though unable to write books and dissertations, in no small degree help to diffuse correct scientific information, and assist in checking the spread of some of those shallow and extravagant conjectures which are being recklessly sown broadcast amongst us at this time. Mr. Stedman was greatly interested in the Meteorological Society, and though it was not possible for him to contribute elaborate memoirs to our transactions, he was an active Fellow of the Society, and frequently attended our meetings. Gifted with great activity and energy of mind and body, he scarcely relaxed work during the last few years of his life, although suffering from serious illness; and was cut off ere he had reached his forty-eighth year, in the midst of his self-denying labours.

APPENDIX II.

The Meteorological Office. Robert H. Scott, M.A., F.R.S., Director.—*Marine Meteorology.* The operations of this branch of the Office have been the completion of the charts, and the discussion of the data for the entire equatorial region of the Atlantic, and the Society will be in a much better position than at present to judge of the work of the Office when the charts, &c. now in the press, for the nine squares (Lat. 10° S.—20° N., Long. 10°—40° W.), of which Square 3 forms the centre, are published. In these charts, as dealing with a larger area, and stretching from shore to shore of the Atlantic, are given not only charts of

the same character as those for Square 3, described in the last Report, (though for larger areas, owing to comparative deficiency of material), but also diagrams showing the direction of wind in connection with atmospherical pressure and temperature, and of ocean currents with sea temperature. There is also given a tabular statement contrasting the specific gravity of the sea in the easterly [going] or "Guinea" current and in the westerly currents due to each trade wind. In the Remarks, copious quotations are made from the Logs in relation to the various phenomena which come under the seaman's observation, such as the weather, the wind, the motion of the clouds in relation to the lower wind, the direction of the swell, the colour and luminosity of the sea, and the current rips; as well as information relating to the birds, fish, and insects that are met with, and the variation from month to month of the localities in which they are seen, and also appearances of submarine volcanic action in certain localities. By these investigations it is believed that important light has been thrown on several subjects of general as well as of special interest. It is hoped that this work will appear in the course of the ensuing summer.

The Office having thus completed the examination of the district close to the Equator, in the Atlantic Ocean, about the most important and interesting to the navigator and meteorologist of any region in the world, has commenced the investigation of the meteorology of another great district lying on the high road between Europe and the Indian and Australian seas, that of the Cape of Good Hope, which will be prosecuted in due course: the question of the best method of dealing with that district being under consideration.

For the inquiry into the weather of the North Atlantic, in August, 1873, the Office has obtained the loan of 280 logs, and the investigation is now in progress. It is hoped that light will be thrown on the actual formation of, and the subsequent modifications in, the serious storms of that month, so that some attempt may be made to solve the vexed problem of the precise direction of the motion of the air in cyclones in reference to the position of the centre of the disturbance.

Weather Teleyraphy. There has been no change of importance during the year in the system of collection of information and issue of storm warnings.

The results of the latter for the year 1874, as given in the Parliamentary Returns, show a total percentage of success of 78.

If it were asked in what particular directions the British system of Weather Telegraphy could most advantageously be developed, the following suggestions may be made:—

A. The supply of cheap self-recording instruments to our principal stations, so that the reporters should be able to furnish intelligence as to the changes which have taken place immediately previous to the epoch for which the report is framed.

B. Additional stations at well-selected points on our West coast, as at Mullaghmore, on Donegal Bay, and at high levels, as at Settle, in Yorkshire. The former especially to give more accurate indications of wind, which from our present stations is often necessarily incorrect, owing to the precipitous character of our western coasts, which affects the direction and force of the wind. The latter to furnish means for a study of the differences of atmospherical conditions in a vertical direction, which has yielded very valuable results whenever it has been prosecuted.

C. Additional reports daily. This is a most pressing want; it has been partially met by the enterprise of the public press: the 'Times' having begun (Jan. 1876) to bear the expense of an evening message from some stations.

D. Improved accuracy in transmission of the reports.

E. Extension of the area covered by our reports. This raises the question of international exchanges, and in this particular it must be remembered that stations are not of equal value, for a report from an outlying post, as Valencia or Sumburgh Head, is worth to the continental meteorologists many times more than a report from a continental station is to us.

The extension of our system westwards, were it possible, would be of incalculable value, but America, and even Newfoundland, are too distant for us to reason with any degree of certainty on what the changes taking place there may portend to us.

Reports from the Azores, if supported by others from Spain and Portugal, would be of value, but they would require confirmation. At least two simul-

taneous reports from independent stations in that group of islands would be required, in order to afford means for checking doubtful statements or errors in telegraphy.

F. An increase of the staff of the Office.

To summarize. More information from existing stations, a large extension of our area of observation, and a reinforcement of the staff for weather study, are the chief requirements of our telegraphic system at present.

The chief feature of novelty in the arrangements for publication of daily reports during 1875, has been the appearance since April 1, in several of the metropolitan and provincial papers of daily weather charts, drawn at the Office, and produced in the form of stereotype blocks by the Patent Type Founding Company. Since January 1, 1876, these arrangements have undergone an important modification, as indicated above, for the 'Times' has agreed to defray the expense of an extra service of reports for 6 p.m. daily (including Sundays), and the charts which now appear in that paper are drawn specially under this agreement.

The co-operation of the Office with the U. S. Chief Signal Office in the synchronous observations, goes on without modification.

Land Meteorology of the British Islands. There is not much of novelty to report in the proceedings of this branch. The issue of the Quarterly Weather Report goes on steadily, and the tables for the various volunteer stations in connection with the Office, for the year 1874, are in the press. As soon as these have been printed, the similar tables for 1875, including returns from the Society's Stations, as intimated in the last report, will be taken in hand and completed without unnecessary delay.

SCOTTISH METEOROLOGICAL SOCIETY.—The work of the Society during the past year, in addition to the regular work of the Office, has been the publication of Papers on—

1. The Influence of Weather on Mortality from Different Diseases and at Different Ages. By Mr. Buchan and Dr. A. Mitchell.
2. On a New Iron Barometer. By Mr. Stevenson, Hon. Sec.
3. On a Self-registering Anemometer. By Mr. Stevenson, Hon. Sec.

Also the following, which are in type, and will be shortly published in the Society's Journal:—

1. Report on all Ozone Observations made by the Society's Observers up to end of 1875.
2. On the Flowering of Spring Plants.
3. On Formation of Clouds.

In addition to the above, Mr. Buchan has written a Paper on the 'Diurnal Barometric Oscillations. Part I.' dealing with the oscillation from A.M. max. to P.M. min., over the whole globe. The Society being unable to publish this discussion, it was offered to, and has already been published by, the Royal Society of Edinburgh, in their Transactions.

An inquiry has been set afoot into the cause or causes of the earliness or lateness of Salmon Rivers, by means of observations made with thermometers continuously immersed in the rivers, and in the sea immediately adjoining their mouths, and by gauging of the water of the rivers. The observations have been going on for some time.

ROYAL OBSERVATORY, GREENWICH. Sir G. B. Airy, K.C.B., F.R.S., Astronomer Royal.—The meteorological work of the Magnetical and Meteorological Department of the Royal Observatory is carried on generally in the same way as for many years past. The direction, velocity, and pressure of the wind, and the amount of rain, are registered automatically (by Osler's and Robinson's Anemometers), and the variations of atmospheric pressure, temperature of the air, and temperature of evaporation, by photographic means; a sufficient number of eye observations of the barometer, and of the dry and wet bulb thermometers, being daily taken for the necessary determination of zero values for the photographic traces. Observations of the daily maximum and minimum temperature of the air, of evaporation, and of radiation, &c. are in addition taken in the ordinary way.

Previous to the year 1875, the graduations of our thermometers rested fundamentally upon those of a standard thermometer (the property of Mr. Glaisher), which derived its authority from comparison with original thermometers constructed by the late Rev. R. Sheepshanks in the course of his work of restoring the National Standard of Length. During the year 1875, however, by the kindness of the Kew Committee of the Royal Society, and the Director of the Meteorological Office, a new standard thermometer, prepared at Kew, has been supplied to the Royal Observatory, and all thermometer readings are now referred to this standard. Our comparisons appear to indicate that the Kew Standard reads, on the average, about 0°·2 lower than that of Mr. Glaisher.

The rain is collected at the Royal Observatory in gauges placed at five different elevations, varying from 50 feet to 5 inches above the surface of the ground. In addition to which, since the beginning of the year 1876, rain has been also collected in a gauge set up at the Police Ship, 'Royalist,' at an elevation of 17 feet above the level of the river Thames.

The vane of Osler's Anemometer made, during the year 1875, eleven complete revolutions in the direction N, E, S, W.

The weather was generally unfavourable for observations of the August and November meteors. The night of November 14 was, however, fine, and a strict watch was maintained throughout; but, owing to the brightness of the moon, only large meteors could be seen. One meteor was recorded on the night of Nov. 13, and twenty-five on the night of Nov. 14. Some of those observed on the latter night do not belong to the ordinary November stream.

The volume of Magnetical and Meteorological Observations, for the year 1873, has been lately published. The information and results contained therein are given in a shape similar to that which has been followed for some years.

Weather reports are sent daily, weekly, or at other intervals to the Paris Observatory, the United States War Department, the Registrar-General, the Meteorological Office, and to various newspapers.

The results of the reduction of the photographic records of the thermometers, from 1848 to 1868, are nearly ready for the printer. Considerable progress has now also been made with the reduction of the corresponding photographic records of the barometer from 1854 to 1873. The barometric results are also being grouped with reference to the Moon, in order to discover whether there exists any measurable Lunar Atmospheric Tide.

It is in contemplation to establish at the Royal Observatory an Electrometer on Sir W. Thomson's plan, for the purpose of obtaining a continuous photographic record of atmospheric electricity.

ROYAL OBSERVATORY, EDINBURGH. Professor C. Piazzi Smyth, F.R.A.S., Astronomer Royal for Scotland.—The amount of input of public funds at the Royal Observatory, Edinburgh, on account of Meteorology, during the past year, has been £120, and the consequent output of work, agreeably to orders, has been the computation of the bi-diurnal observations made at 55 stations of the Scottish Meteorological Society, and their due condensation and arrangement for the reports, printed monthly and quarterly, of the Registrar-General of Births, Deaths, &c., in Scotland.

In the course of the last very rainy summer, the Edinburgh Astronomer was led to recognise a particular set of lines, sometimes coalescing into a broad band, in the spectrum of daylight, which affected a very marked prominence over other lines and bands therein, whenever the atmosphere was charged with watery vapour of high temperature, or more particularly when rain was imminent from the south-east direction; and as that is a quarter from which the barometer is generally very little affected, the daily observation of, or looking out for, this peculiar 'rain band' might prove to be found a useful adjunct to the ordinary means at the command of Meteorologists when attempting forecasts of the weather for short intervals of time.

KEW OBSERVATORY. Samuel Jeffery, Superintendent.—The several self-recording instruments for the continuous registration respectively of Pressure, Temperature, Humidity, Wind (Direction and Velocity), and Rain have been

maintained in regular operation as usual. The daily standard eye-observations for the control of the automatic records have been made regularly.

In addition to the regular work of Kew as one of the self-recording Observatories in connection with the Meteorological Office, the duty of examining and checking the work of all the seven Observatories of the same character has been carried on, in accordance with the method described in the Report of the British Association for 1869.

The only change as regards the photographic instruments has been the substitution of copper chimneys for the gas-jets for the glass chimneys formerly in use, an alteration which has proved to be beneficial.

The result of a careful comparison of the thermogram tabulations at the several observatories, obtained by the use of the fiducial lines traced on the curves by photography, with the standard readings, has shown that the original glass scales supplied (the values for which had been determined at Kew in 1868) were not in all instances sufficiently exact, and new scales have accordingly been supplied where requisite.

The Self-recording Electrometer continues in operation. Some imperfection, of which the cause was not clearly ascertained, interrupted the continuity of the action of the instrument in August; but this was overcome and the record resumed. Experiments for obtaining the scale-value have been made by the use of a battery of 100 Bunsen's cells.

The observations with Thermometers at different levels on the Pagoda in Kew Gardens were resumed in November 1874, after an interval of a few months, and were continued until March, when the experiments were concluded, having lasted over nearly two years. The results have been sent to the Meteorological Office, at the expense of which Department the investigation was conducted.

A commencement has been made of the observation of Solar Radiation at Kew, and Thermometers for that purpose ("Black bulbs *in vacuo*" by different makers) have been placed in the grounds and read regularly.

The Registering Sundial invented by Mr. J. F. Campbell, F.G.S., which has been in operation for several years at the Office of the Local Government Board, 8 Richmond Terrace, Whitehall, has been transferred to Kew, and is in action at the Observatory. It consists of a glass sphere and wooden bowl, and the effect is measured by the amount of wood charred by the sun's action in the course of six months. Experiments are in progress to obtain a satisfactory daily record of the duration of the sun's heating-action by a similar method.

The verification department continues to exhibit increased activity, and, in more than one respect, important steps have been taken with the view of augmenting its efficiency. The following meteorological instruments have been verified—

Barometers, Standards		67
„	Marine and Station	126
		193
Aneroids		21
Thermometers, ordinary Meteorological		1238
„	Boiling-point Standards	64
„	Mountain	20
„	Clinical	1439
		2761

In addition, 272 Thermometers have been tested at the melting-point of mercury.

This department shows a very satisfactory increase in utility, as is proved by the following statement, showing the fees paid for the verification of Barometers and Thermometers during the three years 1873-75:—

	Barometers. £ s. d.	Thermometers. £ s. d.	Total. £ s. d.
1873	72 5 0	110 17 6	183 2 6
1874	55 10 0	157 16 0	213 6 0
1875	88 7 0	214 17 0	303 4 0

The increase has been mainly under the head of instruments received from opticians.

The Committee have it in contemplation to improve the utility of Kew for the verification of instruments by opening an office in London for their receipt, so as to relieve opticians from the trouble of sending the instruments to Kew, and fetching them back again.

13 Standard Thermometers have been calibrated and divided at Kew.

The following miscellaneous instruments have also been verified:—

Hydrometers	150
Rain-gauges	3
Dial Anemometers (Robinson's)	6

A Thermograph has been tested, and its scale-values determined for the Mauritius Observatory.

The apparatus devised by Mr. F. Galton for facilitating the verification of Thermometers, which was mentioned in the last Report, has been erected, and has been found of great service, especially in the way of affording means of maintaining high temperatures for a considerable length of time.

A number of tubes of exceptional range, for the construction of Standard Thermometers, have been added to those at present in stock.

With reference to the testing of Anemometers, as mentioned in the last Report, with the hope that the experiments with artificial rotation would be resumed on a future occasion, it has been found that the large expense which would be entailed to provide a suitable apparatus for use at Kew would exceed the resources of the Observatory. These investigations have therefore not been carried out.

It has appeared desirable to replace the Cathetometer used in connection with the Standard Barometer by a new instrument; and accordingly such an apparatus is in process of construction. As soon as this is completed, it is intended to institute a comparison between the Standard Barometers at Kew and Greenwich, the Astronomer Royal having most readily consented to such an operation.

The other branches of scientific work carried on at the Observatory, Magnetical, Solar, &c. have been regularly proceeded with as usual during the past year.

RADCLIFFE OBSERVATORY, OXFORD. Rev. R. Main, M.A., F.R.S., Radcliffe Observer.—The whole system of observations mentioned in the last Report, for January 1875, has been rigorously kept up till the present time, including the daily observations made at 0h. 45m., Oxford mean time, in connection with the simultaneous observations made throughout a large portion of the northern hemisphere, as proposed by General Myer, U. S. A.

The reductions of the observations are relatively in the same state of forwardness as they were at this time last year, and the volume for 1873 is completely printed, and will be ready for distribution in a few days.

CAMBRIDGE OBSERVATORY. Professor J. C. Adams, M.A., F.R.S.—The meteorological work at this Observatory has been carried on by Mr. Todd, as in former years, the observations being made at 8 a.m. and 6 p.m., for the Meteorological Office ;—these have been reduced, and a Yearly Summary published in the 'Cambridge Chronicle.'

The observations at 0h. 45m. p.m. G. M. T. have been regularly made for the American Government. A Stevenson's Thermometer Stand was erected in the summer, and is found to answer better than the old one.

STONYHURST OBSERVATORY. Rev. S. J. Perry, S.J., F.R.S.—During the course of the past year no new instruments have been added, and no new series of observations started; but the complete set of self-recording instruments, magnetical and meteorological, have been kept in constant use, and the monthly determinations of the elements of terrestrial magnetism have never been interrupted.

The series of magnetic observations made at Kerguelen for five months, and also at the Cape of Good Hope, at Bombay, Aden, Port-Saïd, Malta, Palermo, Naples, Rome, Florence, and Turin, on occasion of the Transit of Venus Expedition, are

due to the Stonyhurst observers who formed part of the expedition. These observations are at present being reduced here.

Observations at all the even hours, day and night, were carried on for five months, with a complete set of meteorological instruments, at Kerguelen; but these results were handed over to the Government on our arrival in England. It is to be hoped that this series of observations, which cost very great labour, and which ought to afford a fair knowledge of the spring and summer weather in the most important island of the South-Indian Ocean, will not remain unreduced.

The series of photographic records of the declination and horizontal force of the Earth's magnetism have been measured and partly reduced; the vertical force curves are being commenced. This series was started in 1867.

The monthly tables of meteorological results continue to be printed for private circulation, and the Annual Report has been somewhat enlarged.

Moorside Observatory, Halifax. Louis J. Crossley, F.M.S.—The work at this Observatory continues as usual. Observations are made four times during the day, and the self-recording instruments continue in constant operation. The Pressure Anemometer was taken down some time since, as it was not working satisfactorily; it may probably be replaced.

VIII. *An improvement in Aneroid Barometers.* By the Honourable Ralph Abercromby, F.M.S.

[Received December 14th, 1875.—Read February 16th, 1876.]

The improvement consists in jewelling the ends of the arbor of the index hand, like the ordinary pivots of a watch, and making the hand work underneath the cap, instead of in the usual manner.

The advantages gained are:—

1. Increased sensitiveness;
2. Increased definiteness of the indications;
3. Diminished influence of weather on the bearings.

If an Aneroid of the ordinary construction, which has been at rest for some time, is tapped, the hand will move a little up or down, according to the general direction of the change of atmospheric pressure. But even then the indications cannot be relied on. The position of the hand will shift along the dial from ·01 in. to ·02 in., or even ·05 in., according to the portion of the case which is tapped, the strength of the tap, and the position of the hand on the dial. The motion is also generally greater with a damp South-West wind, than with a dry East wind.

This "indefiniteness of the indications" exists in every Aneroid I have ever tried, which includes the productions of the leading London makers.

I had the greatest trouble from this defect during my researches on the "Barometric Fluctuations during Squalls and Thunderstorms," the results of which were recently laid before this Society;* and though it is shown in that paper how, by great care, good results may be obtained, still the defect of indefiniteness was so serious that I determined to try and devise a remedy.

An examination of the movements of many aneroids convinced me that

*Quarterly Journal, Vol. II. page 450.

the principal source of error was the play of the arbor of the index hand in its holes; while a lesser source, was the play of the pivots of the crank lever. A simple remedy suggested itself in jewelling the ends of the arbor of the index hand like a watch, and passing the hand under the cap, and also to jewel or otherwise improve the pivots of the crank lever.

The instrument selected for experiment was a 2-inch aneroid by Stanley, of London, of the first quality. As the maker declined from press of business to undertake the experiment, the alterations were carried out under my own superintendence by Mr. Lawson, of Old Steyne, Brighton; while some final adjustments were made by Mr. Casella. Besides jewelling the holes of the arbor of the index hand, the steel pivots of the crank lever were turned very fine, and mounted between two similar brass screws, which have conical holes at their ends, instead of one pivot working in a cylindrical hole in one of its supports, and the other against a brass screw with a conical hole, as in the original instrument.

The result of the experiment has been satisfactory. The indefiniteness, though not perfectly cured, now rarely exceeds ·005 in., instead of frequently amounting to ·01 in. or even ·02 in. as formerly, while the sensitiveness too is so far increased that the instrument will now show easily the ·0025 in., or a difference in height of about 2½ feet. There is also a life and quickness about the motion of the hand which contrasts very favourably with its former sluggishness.

NOTE.—It should be mentioned that watch pivots are jewelled in two ways:—

1. In which a straight pivot passes through a bored ruby plate.

2. In which a conical pivot, after passing through a bored plate, rests on an end stone.

The instrument exhibited has straight pivots; but from the experience now gained, conical pivots would be preferable.

DISCUSSION.

THE PRESIDENT observed that the chief recommendation of the aneroid was its portability. Continuous, although it might be very gradual, depreciation went on in the aneroid, owing to the wear of the parts and the fatigue of the metal of the vacuum box. This source of error did not exist in the mercurial barometer, which remained perfect, provided the insinuation of air into the tube was prevented, as it might and ought to be, and the instrument was not subjected to actual violence.

Mr. SYMONS said that he thought he was a greater believer in aneroids than any one else in the room. One great fault in them is, however, the "position error," which makes the reading of the aneroid vary considerably according to its position. Another was sluggishness; and if the improvement suggested by Mr. Abercromby would make the instrument four times more sensitive, and there was no objection to it, he hoped to see it adopted.

DR. TRIPE said that the object in jewelling the holes was to reduce friction.

MR. STRACHAN said there could be little doubt but that jewelling improved the aneroid, by reducing the friction on the pivots; but it did not do away with the error of position. He had quite recently examined seven new aneroids which had been ordered to be as well made as possible, and to be jewelled. Nevertheless every one of them gave a different reading with the dial horizontal to that with it vertical. The truth was, aneroids for the most part were mere toys;

they were made to sell. While their prices ranged from 15s. to £8, few people would give the highest prices for good instruments. It was necessary that superior workmanship and more scientific skill should be bestowed upon the aneroid to make it a scientific instrument. The same pains bestowed upon the aneroid as upon the English watch would, no doubt, greatly enhance its accuracy. Jewelling was an essential feature of watchwork, and even Geneva watches were jewelled.

IX. *Meteorology in India in relation to Cholera.* By Colonel James Puckle, M.S.C.

[Received January 28th.—Read February 16th, 1876.]

The object of this paper, which is written at the request of the Council, is to bring the relation between the number of deaths from Cholera at Bangalore, and its meteorology, into more prominent notice than could be gathered from the brief sketch submitted to the President, with a printed copy of the meteorological observations taken at that place over a series of years; and to lay before the Society some facts in connection with several serious outbreaks of that inscrutable disease in different parts of the Mysore country during the last 15 years. The facts were recorded at the time briefly, and are now amplified in the hope that a further ventilation of the subject at the hands of an experienced body, may possibly result in some ray of light being thrown on the puzzling question of the genesis and propagation of Cholera, and on the proposition that the meteorological condition of the atmosphere may in some way be the stimulating cause.

Many theories have been brought forward prominently at different times. Each in its turn has for a while been accepted by many as almost a solution of the question, but each has been quickly demolished. Of late, however, it has come to be popularly considered (and it is entirely from this point of view that these notes are put forward), that the disease has generally, or very frequently, originated (1) through the agency of water, *i.e.* by imbibing such as at the time may have been contaminated by the infiltration of sewage, or impregnated by sewer gas; (2) by inhaling deleterious gas, generated from masses of filth and corruption in any shape; or (3) by Cholera poison being conveyed in some way, however distant and tortuous, from the excreta of one victim, to the water or air imbibed or inhaled by another. Complete cleanliness of person and surroundings, thorough drainage, and fresh air, though absolutely necessary to the proper maintenance of health, cannot be relied on for entire immunity from attack; nor can age or sex; for seizures have taken place among the old, young, and middle aged of both sexes, when they have been apparently enjoying a perfect condition of health. Even a dweller in Hygæa might be suddenly seized by the King of Terrors in this form without any reason being apparent on the surface: the cause has to be patiently and keenly sought far and near by skilled professors at *the time of the occurrence*, in the way that the attack of typhoid was lately traced by Dr. Whitmore to the poisoned milk that had been brought from a distance

and distributed at the doors of the sufferers. At the first glance, nothing appeared more unlikely than that the disease should have had such an origin; but a keen and scientific mind, capable of selecting and putting together undoubted facts carefully, and in logical sequence, proved it to be so. In India there are overwhelming statistics, often the result of zeal only, in which case the conclusions drawn from them may be painfully incorrect. A record of facts and observations may, on the other hand, be made with zeal and careful judgment, so far as it goes, but at the same time by persons of insufficient training and experience, in that particular line of tracing an effect to a cause, on which, again, misleading conclusions may be based. Every one in India has too much general work to do. No one has time, so to speak, to devote his whole attention to a special object; and statistics are, as a rule, more remarkable for their quantity than their quality.

In the case of an outbreak of Cholera, a report may be called for by Government, and skilled men may have to submit it; but all that is available, on which to form a judgment, may probably be a record of admissions and deaths, with brief remarks on the treatment in each case, and the ordinary reports of the weather, and other concurrent circumstances. From such records, and from an examination of those who were present, but who may not have the time or skill for *special* investigation, the reporters, however talented, would perforce have to be content. The more skilled, the more readily would they acknowledge the insufficiency of exact information on which to base a sound and logical conclusion. What is required is, that persons of trained skill and experience in such matters should *at the time* make the most special inquiry, the result of which would be worth many quires of statistics that had not such a basis. Except in a few of the largest towns in India, there are no sewers, and no sewer gas proper; and even in these exceptional towns the drainage is incomplete. The general sanitary arrangements are of the most primitive character. In the rural districts the inhabitants adhere to the old Mosaic law. They go forth to the fields, but they do not carry the 'paddle' with them for the purpose that foreshadowed the 'dry earth' system. That necessary part of the work is left to the drying action of a powerful sun, to the kites and other carrion birds, and to village pigs and poultry that are afterwards, doubtless, turned into food: hence the aversion of Englishmen to pork and bazaar fowls and turkeys. In this way it is not difficult to conceive that sewage of the direst and most unadulterated kind may possibly be taken into the system through poisoned meat. It may also, during rainfall, find its way to the open *tanks* (as the irrigation reservoirs are called, which vary in area, from a water-spread of an acre or two, to several square miles) and wells, from which the inhabitants draw their water supply. At other times during the hot dry weather, malaria may arise from putrescent matter, from which impalpable but morbific dust may be distributed through the agency of the atmosphere. If the excreta of Cholera patients are to be found so exposed—and who shall say they are not?—then the propagation of the poison may be easily imagined. It is readily intelligible, too, that during such hot weather, when the *tanks* are much below the

usual spring level, any contamination that may be carried into them by light rainfall must be obviously much more harmful, from the fact of its being less diluted, than when the tanks are full. This may account for the spread, during light rainfall, of the disease at a time when there is a dearth of water, and for its subsidence being coincident with a heavy rainfall, that would fill the chains of tanks and wash all impurities away.

In 1873 the Sanitary Commissioners reported to the effect that Cholera broke out first in the rural districts, and was imported therefrom into the towns,—a reversal of the generally accepted view of the matter; but any district officer would be able to bring forward facts to show that on many an occasion within his experience, whole villages, remote from any town, have been almost depopulated; and that its spread has been arrested by the inhabitants of the surrounding villages cutting off all communication with the one so affected.

The origin, however, would remain unexplained in most cases. In large towns the Mosaic practice, as described above, is persisted in where waste sites and ruined enclosures invite it, and the police are not vigilant; but, in addition to this, any accumulation of filth would, in such weather as Cholera appears to delight in, give out harmful exhalations that might be taken into the system by water or air. Should the excreta of Cholera victims form part of it, then its propagation may be traceable thereto.

Damp, warm weather is said to engender general sickness, for, according to a recent report, the death rate has increased in Madras from 33·4 per 1,000 in 1872, to 37·1 in 1874, that is, since the introduction of a general water supply by stand pipes, &c. and its more general use by the inhabitants, with insufficient drainage to carry off to a proper outfall the water so used. It is understood, however, that the proper remedy for this unsatisfactory condition of things is about to be applied.

Orthodox native opinion on the subject is that Cholera is a visitation of the malignant power Mariamma or Mahámári, the chief of all the evil spirits who preside over the lesser plagues of fever, small pox, measles, &c. Mariamma, they say, holds sway over, and controls and directs, Cholera, the direst and most fatal disease of all, for which they know no remedy, and only one general treatment, which is to dose the patient with copious draughts of sour water gruel. On any epidemic occurring, the chief and only object is to appease the wrath of the offended power with oblations, ceremonies, and sacrifices of sheep and buffaloes, and by burning camphor and incense, and lighting bonfires, according to the severity of the attack, Mariamma being only to be appeased by blood and fire. In addition to these special observances, there are annual ceremonies lasting for a week, during which sacrifice is made to the powers of evil *collectively*. Processions are then formed, that parade all the streets and village bounds, burning large quantities of camphor and incense (which are also burned in each house), and making night hideous with their frantic yelling, and extravagant ceremonies and orgies. But the more intelligent (the number is daily increasing) readily admit that all this is unavailing, and that dirt and overcrowding are sure hotbeds of

disease. Taking advantage of this, the sanitary maxim that "Dirt in the town is the mother of Cholera, but if carted to the fields it becomes rupees in the pocket," has been inculcated, not without some practical result.

The native idea that fevers of all kinds are propagated by drinking impure water, is strongly corroborated by the published facts regarding the Cholera epidemics in England during 1832, 1849, 1854, and 1866. In the first three of these the prisoners at Millbank suffered severely, the death rate from Cholera and Typhoid, *previous to* 1854, being very high. During the last year, 1866, no case of Cholera occurred, and from 1854 to 1872 there were only three deaths from Typhoid, the reason given by Dr. DeRenzy being to the effect that these beneficial results were solely due to the change of water. Previous to the 10th August, 1854, this had been drawn from the river at Millbank, and purified (?) by filtration. From that date it was drawn from the artesian well in Trafalgar Square. The epidemic was then at its height, but in six days from the date of the change of water *Cholera ceased, and never appeared again.* Since that time the Report states that Typhoid also almost ceased; and that Cholera and Typhoid never appeared among the Pentonville prisoners, their death-rate from other causes being only about six per thousand, due chiefly, it was thought, to the supply of good water from the chalk. What Londoners suffer in this respect let the Rivers Pollution Commissioners' Reports testify! Against the water theory may be noticed the Minute of the Army Sanitary Commission for 1873, when Epidemic Cholera occurred in the gaols of Moulmein, Rangoon and Thyetmyo—(it was in this year that the rural population were attacked before the towns), as the following extract shows:—

"Now as regards the probability of the poison which causes Cholera being received by, or developed in, or propagated through, water as a medium, it is certainly true that the cessation of the disease in the Moulmein Central Gaol was synchronous with the closing of the wells; on the other hand, although the water in the wells in the Thyetmyo Gaol was used throughout, the disease ceased sooner there than in the Moulmein Gaol; and in the Rangoon Gaol the greatest number of admissions and deaths took place after the prisoners had begun to use the water of wells, taken from a place the inhabitants of which had not a single case of Cholera amongst them:"—

It is presumable that Cholera poison somehow existed in the Moulmein Gaol well, and that the arrest of the disease was due to the change, as at Millbank. The information regarding the Moulmein and Rangoon Gaols is very puzzling, but perhaps if a critical analysis of all the circumstances had been made by competent persons *at the time of the occurrence*, further light might have been shed on the apparent mystery. Of course, this is on the assumption that the Commissioners drew their conclusions from information received *after* the event.

Failure of the usual rainfall at the proper season, high harsh winds at one time of the day, and a stagnation of the atmosphere at another time, when a sense of oppression is often felt, as if there were insufficient air to breathe, and an abnormally high temperature, have been concurrent with the several

attacks in Mysore and Southern India that are herein spoken of. It may be difficult to prove that the disease has been controlled by a change of water, or that the low state of the tanks and wells has helped to propagate it; but it will be shown that change of air and surroundings has had the most beneficial effect, and that ordinary sanitary practice, and prompt dealing with an outbreak, have prevented many evil consequences. Before, however, giving an account of some that have come under my personal knowledge, it is desirable to insert a brief description of the climate of Bangalore and of its situation, in order that some singular instances of immunity of one part or other at different times may be investigated.

Bangalore is 3,000 feet above mean sea-level, and enjoys, for India, a temperate climate, as evidenced by the fact of apples and roses being procurable all the year round, and strawberries and peaches for six months out of the twelve. From the middle of December to the middle of April hardly any rain falls; the climate is very dry in February, and in March especially so; during this time the wind blows, sometimes with great force during the day, generally from the north-east and east; from the middle of April to the beginning of June, variable winds and occasional thunderstorms prevail, and during June and July strong south-westerly winds, with rain at intervals; the months most depended upon for steady rain being August, September and October. In November and the beginning of December, the wind has veered round again and settled to the eastward of north, when occasional showers only are experienced. The mean corrected observations of the thermometer for the whole year, on the averages for 1872, 1873 and 1874 being struck, are as follows:—maximum 88°·88, minimum 64°, and mean dry bulb 72°·47; and (the maximum being 100) the humidity is 69. In March 1874, a very dry and hot season, the average for the month was 43 only. The rainfall for that year was 56·65 inches, spread over 127 days, but the mean for a series of years is 35·26 inches, over 83 days only. By the last census, the population of Bangalore was 147,000, viz. in the Pettah (or old native town) nearly 50,000, and in the Cantonment nearly 100,000; and although they are divided by a strip of land of irregular width, averaging about half a mile, they are practically one town, governed by one municipal commission. The Pettah, however, is in the watershed of the Arkavutti River, while the Cantonment is in that of the South Pennair, the geological conditions of which differ; and the water supply may in some way be affected by this. At pages 16 to 18 of the pamphlet already referred to, details of each day's meteorology for the months of July, August, and September, 1860, are given, as well as the daily record of deaths from Cholera. In January, February, March, and in the previous December, no rain fell, and only a few *cents.* in April. In May there were storms, but June was dry and harsh, and the rain that fell was generally in light showers, that barely moistened the earth. It was the same in July, when the scarcity of water was very great, the wells and tanks being extremely low. Added to this, there was in all June and July a harsh irritating SSW wind that blew generally from about 9 a.m. to 5 p.m., with occasional lulls for a day or two, when the weather was very trying and oppressive.

On the 10th July the first Cholera death took place, then there was an interval, then for a week there were one or two deaths per day, when they suddenly increased to 14, from which date the death rate continued to rise till the 30th and 31st, and the 1st and 2nd of August. On those dates (the summit of the Cholera wave), the deaths were respectively 50, 58, 60, and 75, in the Cantonment alone. The numbers fell during the next four days to 25, 16, 32, and 23, and from the 8th to the 31st of August they continued steadily to decline. During September the deaths were comparatively few, and on the 30th the epidemic had died out. On the advance of the wave, and towards its culmination, the virulence of the seizures was very great; treatment seemed of no avail, and during the four days at the end of July and beginning of August, there was much depression and subdued alarm. There seemed to be no effectual remedy, and no palliative; and the sense of relief was undoubtedly great when the four terrible days were over, and the gradual subsidence of the plague had fairly set in. On the ebb of the wave, the diminution in the severity of the seizures was as noticeable as their greater amenability to treatment; and this amelioration continued, till recovery almost always attended the later cases. "Very high wind, occasionally almost due south, prevailed all the month. Sky generally overcast; heavy rain often threatened, but rarely fell; Cholera broke out severely in the Cantonment, but mildly in the Pettah; it was severe in several talooks of the division; the seed that was sown withered from the drought, but generally the agriculturists had not, from the same cause, been able to sow their crops." Such is the brief note made at the time. It is enough to say that rain fell plentifully from the middle of August, which not only assured a fair water supply, but appeared to wash away the exciting cause, whatever it was. Up to that time, however, the drought was excessive, and the poorer people had not sufficient for washing or drinking. The total deaths from the 10th July to the 30th September were as follows:—

	July.	August.	September.		Total.
In the Cantonments, Europeans and Eurasians . .	8	23	0	=	31
Do. Natives . .	268	392	84	=	689
In the Pettah, Natives during total period		.	.	.	106
					826
And in Country around Bangalore do.		.	.	.	566
					1392

In September, 1868, when in civil charge of the Toomkoor district, an attack of Cholera occurred at the gaol, which is on high ground just outside the town. Though the disease had hardly shown itself before, a death was reported early one morning, and before noon there was another sudden death, and two more seizures, which created general alarm. In consultation with the apothecary, who was the only medical authority present, measures

that previous experience had suggested were without delay adopted. The men were personally assured that only such light work would be exacted from them as would amuse and interest, but not weary, them. Spiced brandy was given to any who appeared ill or weak, and Cholera pills were distributed to the police stations for supply to any applicants. Preparations were made to march the men five miles into the country, so as completely to segregate them and give them change of air and scene; while the gaol was being swept out with fire and smoke, and every thing dirty around it destroyed and burnt; the floors were also dug up, and the soil around it was similarly treated; better arrangements were also made for the treatment of the excreta by the dry earth system, and the drainage was remodelled. It was not possible to move the men into camp till the afternoon of the third day, during which time the disease ran its rapid course in the usual way.

On the prisoners being removed to fresh air and scene it as suddenly declined; but during the few days of which mention is made 19 seizures took place, more than 12 of which terminated fatally (the brief note taken at the time does not state the exact number, but a copy of the official report could easily be obtained): one was attacked as the gang were marching out, he was therefore sent back to a house a little way from the gaol that had been taken for the purpose, and to which others who were suffering had been removed. From that date there were no more seizures, and all who were then under treatment recovered, including three persons who were attacked in the town,—The Cholera was in fact stamped out. The men who were moved into tents, and such shelter as could be provided temporarily five miles away from the town, recovered at once their spirits and tone. The report received on the morning after their departure was most encouraging in this respect, no fresh case occurred among them, and at the end of a week they were marched back to a thoroughly cleansed gaol. Owing to this mode of treatment the town was kept free with the exception of the three cases mentioned above. The people's minds, however, were filled with much alarm at the suddenness of the attack, and there was some expression of opinion that its cause was due to the "new-fangled" mode of making them clean their streets more thoroughly, and whitewash their houses, which proceeding, they said, had aroused the anger of Mariamma, who had in consequence visited them in the shape of a swift epidemic. They afterwards, however, freely acknowledged their mistake, and admitted that cleanliness was better than dirt; adding that two years previously Cholera appeared in their town and remained among them for two months with many fatal results, whereas in the present instance, though extremely sudden and severe, it had been controlled and finally stamped out in a week. This candid and practical admission was all the more gratifying, as it appeared to be one that years of preaching would scarcely have aroused. The same rise and fall of the disease will be noticed here, except that it was more rapid and alarming in its action, and demanded very active measures to counteract it. The same meteorological conditions were present as at Bangalore.

In June, 1866, when similarly in charge of the District of Mysore, a sharp

outbreak took place. There was the same high dry south-westerly wind during the day with a complete lull from about 5 p.m. to 8 a.m., and occasionally an absence of the wind for two or three days together, depending, as it appeared to me, on particular phases of the moon. The crops that had been sown in the "first" rains had failed entirely owing to the absence of "latter" rain, and there was a great dearth of water. The bulk of the main cereal crop (*eleusine corocana*) had not been sown, and there was great scarcity, almost amounting to famine. The low and filthy state of the water in the *tanks* and wells aggravated the distress, and many of the poorer classes could not get sufficient wholesome food to eat. There was an abundant supply of mangoes, which were eaten in all stages of decay, and later on, roots and the pith of the aloe, *agáve vivipara*, and similar substances were freely consumed by those who were literally starving. At this time, too, there was a movement of grain from Mysore to other parts of the country that were sorely pressed, which greatly exercised the minds of the people, who could not understand the policy of non-interference in the matter. For about 10 days previous to the 9th of June there had been a dropping case or two of Cholera, but suddenly, on the evening of that day, when leaving Cutchery, a messenger in much agitation reported that during the night, and up to that time, 36 people had died; the alarm was great, almost a panic, and sudden measures had to be adopted without loss of time. Dr. Houston and I were the only responsible officers on the spot when the report was received, and after a brief consultation we walked through the town to give confidence to the people, assuring them that all should be done that was possible to relieve their distress. Pills and spiced arrack were prepared and distributed to the police stations the same evening, to be given to those who needed them, and on the following morning the heads of the different sects were summoned to a conference, and encouraged to aid our efforts by reassuring the people, and getting each division of the town cleansed of the surface dirt as far as possible. This had the double effect of giving employment in the right direction, and subduing alarm, which idle gossip might create.

The weather on the 9th, and for nearly a week before, had been muggy. The casualties by Cholera from the 1st to the 8th had been only four, but on the 9th, 10th, 11th and 12th they rose to 36, 34, 36 and 27 respectively, and on the three following days were 20, 12, and 14; then for four days there were 10 per day, and from the 20th to the 30th inclusive the deaths were recorded in single numbers, down to 3 and 2 on the last two days. Altogether, from the 3rd to the 30th, there were 290 deaths in this town, viz. 163 males and 127 females, of which number 156 were Mussulmans and 134 Hindoos, as shown in the following statement:—

Date.	Male.	Female.	Total.	Mussulmans.	Hindoos.
3	—	1	1	—	1
6	1	—	1	—	1
7	1	—	1	1	—
8	1	—	1	—	1
9	18	18	36	19	17
10	18	16	34	15	19
11	23	13	36	26	10
12	12	15	27	18	9
13	10	10	20	16	4
14	9	3	12	4	8
15	9	5	14	7	7
16	7	3	10	9	1
17	4	6	10	5	5
18	8	2	10	4	6
19	6	4	10	3	7
20	3	5	8	4	4
21	6	3	9	6	3
22	6	2	8	4	4
23	4	3	7	5	2
24	4	1	5	4	1
25	—	4	4	2	2
26	2	6	8	1	7
27	6	3	9	2	7
28	2	2	4	—	4
29	2	—	2	1	1
30	1	2	3	—	3
Totals	163	127	290	156	134

N.B.—The Mussulman Population bears to the Hindoo Population a ratio of only ½ to 1.

The severity of the attack in the more crowded and dirty Mussulman quarter will be better understood when it is stated that they number only one-fourth of the Hindoos. The oppressiveness, and muggy state of the weather just before, and during the worst of the attack, were specially noticed by several. It was also the subject of general remark that some light warm rain which fell in the first week of June seemed to increase the oppressive temperature. The deaths at first were often very swift. In one case a man died after 1½ hour's illness, but after a time they were less severe. The progress, culmination, and subsidence of the attack, it will be observed, were exactly similar to the others.

In July of the same year I was called in to Bangalore to take the post of Chief Magistrate of the town, and Hon. President of the Municipal Commission which, with the sanction and hearty support of Mr. L. B. Bowring, the then Chief Commissioner of the Province of Mysore, I had inaugurated in 1861. The rain still hung off, and early in September famine appeared so imminent, that the Chief Commissioner called a public meeting to discuss the best mode of dealing with the situation. Funds were subscribed, and large soup kitchens were at once established in the Cantonment and Pettah (which in that year were separately administered), and several hundred people were daily fed in each place for some time. Previously to this, Cholera broke out

suddenly and sharply, when Dr. Oswald, the surgeon to the Commission, and I, repeated with marked effect what had been done in Mysore. What seemed to be the chief blot, and possibly exciting cause, was the open irregular ditch that ran through the heart of the town, varying in width from 30 to 60 feet. It was literally a pestiferous cesspool from beginning to end, with patches of rank vegetation growing here and there. This foul place was at once attacked; and after anxious consultation, and carefully weighing the question in all its bearings as to prospective benefit, and the possible harm that might accrue to those immediately engaged in the necessary work, two hundred labourers, men, women and children, who were suffering from want of work and food, were assembled to cover up the place with a foot of fresh earth, to dig up and expose to the air the saturated soil in the neighbourhood, to clean out the public wells, and to collect and burn all rubbish and dirt that could be so treated. Energetic supervision was given, and every care that forethought from every point of view could suggest, was taken to prevent as much as possible their coming to harm. Under Dr. Oswald's advice, only so much work was exacted as their weakly condition was thought capable of; generally from half to three quarters of a full day's work was paid for at the full day rate, the cause being explained to prevent the establishment of a precedent.

By putting them in heart as much as possible they worked well, and no case of Cholera occurred among them. The actual outbreak, though sudden and sharp, was in this way, by taking the bull by the horns, providentially arrested in a fortnight or less. The number of deaths is not entered in the notes, but my impression is that only 16 took place, and none among the work-people who filled in the reeking disease-bearing nullah in a very short time. With comparatively light work under intelligent and thoughtful overseers, good pay, and occupation, which at that time of scarcity they would have been without, they were free from the disease, which is a noteworthy fact. The agriculturists in the district were also much distressed, and the atmospheric conditions were generally as recorded on previous occasions. It is but right to add that the municipality did not rest content with the temporary expedient, but as soon as practicable the foul nullah was converted into a properly constructed open stone drain 15 feet wide and 4 feet deep, spanned at intervals by hand bridges, and with broad roads on each side of it. The drainage and water supply of the town, which are still primitive, are now being comprehensively dealt with.

From that date the Cantonment was free from Cholera for two or three years, when it was attacked, and the Pettah spared; while in 1869 a very sharp attack took place in the Pettah, when the Cantonment was spared; and and other instances may have occurred, but I have no notes on the subject. This singular immunity demands close and scientific inquiry.

For four or five years Bangalore has been remarkably free from the disease, but in November last it prevailed so badly at that station, and at Madras, as well as in the Coimbatore and Salem districts, that the Prince of Wales, to the great regret of the people, was advised not to pay his contemplated visit to Bangalore and the beautiful Neilgherries. He fortunately

went to Madras, though at one time it was doubtful if he would do so, as Cholera had for some months been prevalent, as the accompanying return of deaths, and ratio per 1000 of the population as compared with the mean results of the previous ten years, clearly shows,—

Week ending.	Total Deaths 1875.	Ratio per 1000 1875.	Mean Deaths 10 yrs.	Per 1000 10 yrs.
6th Aug...	0	0·0	26·7	3·4
13th ,, ...	15	1·9	33·5	4·3
20th ,, ...	45	5·8	25·7	3·3
27th ,, ...	67	8·7	26·6	3·4
3rd Sept..	106	13·8	26·2	3·4
10th ,, ...	77	10·0	18·6	2·4
17th ,, ...	62	8·1	23·0	2·7
24th ,, ...	51	6·6	19·9	2·6
1st Oct....	47	6·1	15·6	2·0
8th ,, ...	27	3·5	13·1	1·7
15th ,, ...	28	3·6	10·7	1 3
22nd ,, ...	46	6·0	10·9	1·4
29th ,, ...	50	6·5	5·3	0·6
5th Nov...	50	6·5	4·3	0·5
12th ,, ...	36	4·7	2·9	0·3
19th ,, ...	36	4·7	2·0	0·2
26th ,, ...	40	5·2	4·2	0·5

The total deaths from the 1st of August to the 26th of November were 783, while in the corresponding period for 1874-73-72-71 the numbers were respectively 0—4—0 and 138. From the last date to the 17th of December 109 more deaths occurred, which swelled the total to 892. The Salem district lost 4 per cent. of its population in a few weeks. Coimbatore suffered severely. In the Kistna district six out of twelve attacked, died. The Nellore, Cuddapa, Bellary, Kurnool, Madura, Tinnivelly and North and South Arcet districts all suffered more or less. In the last, 539 deaths were reported in one month. At Bangalore the attack was sharp but short, when compared with that in 1860. Dr. Oswald writes to me that on the 4th of November there was but one death in the Cantonment, but that they became increasingly frequent to the 23rd and 24th, when the largest number of seizures and deaths took place, after which the epidemic steadily declined, and ceased on the 4th of December. Altogether it is stated that of the 500 seizures reported, nearly 300 deaths occurred, and these, with the exception of a dozen or so cases in the Pettah, were all in the Cantonment, another curious instance of the immunity before spoken of. Only 22 inches of rain had fallen up to the 4th of December, and there was a total absence of the heavy dews that prevail in the early morning at that time of year. The temperature was abnormally high, but the general health of the public was reported to be remarkably good.

Later accounts show that the state of the water supply in Bangalore and

in the Province generally is causing serious consideration, and that famine works are already being put in hand.

The same progress, culmination, decline, and attendant circumstances, are here also apparent, and every where the same story is told of the occurence of Cholera last year being coincident with prolonged absence of rain, and a temperature abnormally high. Obviously, however, more details than are given in this paper are necessary before any definite conclusion can be arrived at in regard to the relation that Meteorology may bear to any outbreak of Cholera; but it seems desirable that most carefully conducted meteorological observations should be fully made and recorded at all times, (more particularly so during Cholera) with the same kind of instruments at every station, *under precisely the same rules and system*, so as to admit of careful comparison and analysis at some central station, and a just conclusion being based thereon by a competent professor. In the mean time every effort should be made to prevent epidemics as far as possible, by preserving the conditions of *clean soil*, with a plentiful supply of uncontaminated *water* (and proper means for getting rid of it when used) and *air*.

DISCUSSION.

The PRESIDENT said that there had recently been a considerable addition to the List of Fellows from the Medical Officers of Health, to whom this Paper would be acceptable. The general features of the weather preceding and accompanying the outbreaks of cholera described,—high temperature, a close atmosphere and scarcity of rain,—were similar to what had been observed in England in the epidemics of cholera in 1849 and 1854. But it was not always so; when cholera was epidemic in Jessore in Bengal, in 1816, instead of the usual rainy and dry season, scarcely a week was without rain, and the sun was constantly obscured; and the summer of 1866, when cholera was last epidemic in London, was a rainy one. Dr. Tripe had devoted much attention to the connection between temperature and disease; and Mr. A. Buchan and Dr. Mitchell, of Edinburgh, had published an elaborate paper "On the influence of weather on mortality from different diseases" in which the effect of the high temperature of summer in developing this disease in London had been clearly proved. On the other hand, there had been a severe outbreak of cholera in St. Petersburg during intense frost.

Colonel PUCKLE said that although he had made no note of it, he remembered exactly the reverse to have taken place on one occasion at Bangalore. The facts mentioned in the paper were his impressions on the subject, recorded in brief notes at the time of their occurrence.

Dr. TRIPE said that the Paper had been referred to him, and he reported that he thought it would be acceptable to the Society and to the public generally, as the experiences of non-professional men on a subject such as this are very useful. In this country cholera does not usually break out except when the weather is very hot; it very seldom assumes an epidemic form in winter, but generally a sporadic one, or at the most is endemic, that is to say, prevails more or less severely in particular localities. The only way to deal with it is by isolation. One case had occurred in his own district (Hackney) which came from Bow; one after another of the members of this family were attacked and carried cholera with them to whatever places they were removed, so that one or more of those who nursed them were attacked and died. He believed that the spreading of the disease does not always arise from atmospheric conditions, but that to a great extent it spreads from person to person. The author of the Paper mentioned that there was no fog, which did not correspond with what he (Dr. Tripe) had observed, as he saw fog or blue mist at Bow a few days before the last outbreak. The mist was also visible over the Hackney Marshes, and continued at intervals

to be perceptible there till the disease had subsided. The number of deaths from diarrhœa correspond so closely with the mean temperature that they can be calculated from the curve of temperature. The deaths from this disease, however, have increased of late year by year, and therefore are clearly not altogether dependent on the heat of the weather; indeed, it is very probable that the mortality depends to a considerable extent on the drainage of the soil on which the houses are built.

Mr. J. P. H. WALKER offered some remarks from personal experience gained in Orissa, where, for a number of years back, he had superintended public works on a large scale on which large bodies of workmen were continually employed. There was one period of the year which he always dreaded, viz. from the middle of February to the beginning of April, when the NE Monsoon is just dying out and the cold dry wind which, in Cuttack, is generally experienced during this Monsoon from the north-west, is replaced by variable winds and breezes from the sea of a moist and warm character. At this period cholera was sure to break out, leading to the speedy dispersion of the workmen. The medical officers, when consulted as to the causes of the outbreak, would venture on no explanation. Generally it was assumed that the disease was brought into the country by the pilgrims who traversed Orissa on their way to Juggernath, but towards the end of June and beginning of July, when the concourse of pilgrims from all parts of India passing through the district is greatest and cholera might be supposed to be most rife, the works were generally free from disease. The men employed on the works under his charge were provided with huts laid out with regularity and so as to ensure the free circulation of air, and were kept as clean as possible. There was also a fair supply of fresh water. His own impression, therefore, was that the appearance of the cholera was in some way connected with the atmospheric conditions which prevailed between February and April when changes in temperature were very sudden, and he could speak from experience of the very relaxing effects of the currents of air coming at that time from the SE or seaward quarter. Owing to the variable character of the wind, thick mists, especially in the morning, were prevalent at this season of the year, though occasionally heavy mists were experienced a month earlier. The sudden changes in temperature affected the native workmen much more quickly and powerfully than Europeans, owing to their being so lightly clad. Such changes in temperature were in his opinion often intensified by, and perhaps at times due to, the burning of the jungles, which are periodically fired in February and March to facilitate the growth of young grass for cattle grazing. Strong draughts of air are generated and much local atmospheric disturbance is created by the large area of superheated atmosphere,—the effect of the jungle burning. During this time mist was generally prevalent, and the same conditions prevailed at other places.

Mr. SCOTT wished to know whether it was fog or dust haze.

Colonel PUCKLE said that although locally called a fog, it was in reality one of those very heavy dews that occur in November and December. They are sometimes so dense as to resemble fogs, but are dissipated by about 8 a.m., after which there is clear Italian sky for the rest of the day.

Mr. WALKER said that if an outbreak of cholera was prolonged into April and May the mists would disappear, and the usual hot weather dust-haze would succeed.

Captain TOYNBEE said that the long shore southerly wind which blew at Madras in March (the season alluded to by Mr. Walker) carried with it the moisture from the surf, which, becoming mixed with the red dust from the roads, formed a kind of paste and adhered to the skin, causing boils. This relaxing wind seemed to predispose the system for any disorder that might attack it.

Mr. FIELD said that this was a very valuable paper, containing a great many facts. It was most desirable to have the opinions of men of different professions, who looked at it from different points of view. With reference to the effects of meteorological conditions on cholera, they appeared to him to be of two distinct kinds, viz. the *direct* and the *indirect*. The direct influences, such as those due to changes of temperature, hygrometric conditions of the atmosphere, &c. were those generally considered, but he was inclined to think that the indirect influences, such as the effect of heavy rains in washing impurities into the water supply, or raising the level of underground water, were quite as important. In

illustration of this, he referred to cases of the contamination of water in wells which had come professionally under his observation.

Mr. SYMONS said that like meteorological conditions may have exactly the opposite effect according to the circumstances upon which they operate. For example, a heavy rainfall may, by providing abundant pure water, diminish disease, or it may, by washing surface impurities into drinking-water-tanks, be its most powerful promoter. He remembered that during the outbreaks of cholera in 1849 and 1854 the weather was very muggy, accompanied by a thick, stagnant, murky atmosphere, which was quite the reverse of what had occurred at Bangalore, for he noticed in the pamphlet which Colonel Puckle had presented to the library, that the wind attained its maximum velocity during the greatest prevalence of cholera.

Colonel PUCKLE said that the high wind blew generally from about 8 or 9 a.m. to 5 p.m., the remainder of the day being characterised by a stagnation of the air that had a depressing effect, and made one sometimes almost gasp for breath.

Dr. SQUIRE wished to support the indirect theory alluded to by Mr. Field. Typhus fever was more prevalent in winter; the cold weather indirectly intensifies the disease by leading to overcrowding among the poor by causing the sick rooms to be closed for warmth. But typhus was not less catching in summer if free ventilation were neglected. The same may be said of smallpox. It is a mistake to suppose that cold weather arrests epidemics; if it checks cholera, it does not prevent it. One of the worst and most fatal outbreaks in the epidemic of 1848-49 occurred under his own observation in the winter, showing that cold *per se* does not destroy the disease-germ. The poison of the disease comes from the bodies of the sick, and not from atmospheric states; unless, indeed, the presence of disease particles were considered as a state of the atmosphere, as it very properly might be. Meteorological reports would gain in value if they contained an account of the diseases prevalent at the time.

Dr. DICKSON said that Meteorology plays an important part in the causation of most diseases, and chiefly in those associated with high temperature by *increasing the susceptibility of persons* to the action of morbid poisons. The nature of the cholera poison is still mysterious. He had seen it in many climates, and found that, like diarrhœa and typhoid fever, it generally occurs in hot weather, and is checked by cold. There are, however, remarkable exceptions. Cholera, even when widely diffused, appears to seize a comparatively limited number of persons exposed to it. It would be valuable to have a registration of cases of diseases as well as of deaths, as some prevalent diseases are rarely fatal. He had registered for many years cases of summer diarrhœa, and their ratio compared with temperature and moisture gave curious coincident curves. As a rule, cold and wet summers were most free from bowel complaints, but occasionally very hot and dry summers were also equally free, and this he ascribed to fruit being plentiful and cheap, and used in moderation as an article of daily diet, it appeared to prevent the diarrhœa, which would otherwise occur from atmospheric causes.

PROCEEDINGS AT THE MEETINGS OF THE SOCIETY.

JANUARY 19th, 1876.

Annual General Meeting.

ROBERT JAMES MANN, M.D., F.R.A.S., President, in the Chair.

Mr. PASTORELLI and Mr. STRACHAN were appointed Scrutineers of the Ballot for Officers and Council.

Dr. TRIPE read the Report of Council and the Financial Statement for the past year (p. 49.)

It was proposed by Mr. WHIPPLE, seconded by Mr. STRACHAN, and resolved:—"That the Report just read be received and adopted, and circulated among the Fellows."

It was proposed by Mr. SCOTT, seconded by Mr. MYLNE, and resolved:—"That it be referred to the Council to consider whether or not it would be advantageous to alter the hour of Meeting to 8 p.m. from 7 p.m."

The PRESIDENT then delivered his Address. (p. 37.)

It was proposed by Mr. DINES, seconded by Mr. BREWIN, and resolved:—"That the best thanks of the Society be given to the President for his very able Address, and that he be requested to allow it to be printed in the Society's Journal."

It was proposed by Mr. SOUTHALL, seconded by Mr. TABOR, and resolved:—"That the cordial and best thanks of the Meteorological Society be communicated to the Council of the Institution of Civil Engineers for having granted the Society free permission to hold their Meetings in the rooms of the Institution."

It was proposed by Mr. SMYTH, seconded by Mr. BAKER, and resolved:—"That the best thanks of the Society be given to Dr. Mann for his services as President during the past two years and a half."

It was proposed by Mr. DYMOND, seconded by Mr. SOPWITH, and resolved:—"That the best thanks of the Society be given to the Officers and other Members of the Council, and to the Auditors for their services during the year."

It was proposed by Mr. LAUGHTON, seconded by Mr. BICKNELL, and resolved:—"That the thanks of the Society be given to Standing Committees, and that they be requested to continue their duties until the next Council Meeting."

THE PRESIDENT then announced the result of the Ballot, and declared the following gentlemen to be the Officers and Council for the ensuing year:—

President.

HENRY STORKS EATON, M.A.

Vice-Presidents.

CHARLES O. F. CATOR, M.A.
ROGERS FIELD, B.A., Assoc. Inst. C.E.
JOHN KNOX LAUGHTON, M.A., F.R.A.S.
Capt. HENRY TOYNBEE, F.R.A.S.

Treasurer.

HENRY PERIGAL, F.R.A.S.

Trustees.

Sir ANTONIO BRADY, F.G.S.
STEPHEN WILLIAM SILVER, F.R.G.S.

Secretaries.

GEORGE JAMES SYMONS.
JOHN W. TRIPE, M.D.

Foreign Secretary.

ROBERT H. SCOTT, M.A., F.R.S.

Council.

PERCY BICKNELL.
ARTHUR BREWIN, F.R.A.S.
CHARLES BROOKE, M.A., F.R.S., F.R.C.S.
CORNELIUS BENJAMIN FOX, M.D.
FREDERIC GASTER.
JAMES PARK HARRISON, M.A.
ROBERT JAMES MANN, M.D., F.R.A.S.
WILLIAM CARPENTER NASH.
Rev. THOMAS ARTHUR PRESTON, M.A.
WILLIAM SOWERBY, F.L.S.
CHARLES VINCENT WALKER, F.R.S.
GEORGE MATHUS WHIPPLE, B.Sc., F.R.A.S.

Dr. MANN having left the Chair, it was taken by the newly-elected President Mr. EATON, who adjourned the Meeting to February 16th.

FEBRUARY 16th, 1875.

Ordinary Meeting.

HENRY STORKS EATON, M.A., President, in the Chair.

FRANK C. CAPEL, North Cray Place, Foot's Cray;
ZOPHAR HUMPHREYS, Aberystwith;
EDWARD MAWLEY, Lucknow House, Addiscombe, Croydon;
Rev. GEORGE H. MULLINS, M.A., West Deyne, Uppingham;
WILLIAM HENRY WATSON, F.C.S., Braystones, Beckermet, Carnforth; and
CHARLES THEODORE WILLIAMS, M.D., 47 Upper Brook Street, W.,
were balloted for and duly elected Fellows of the Society.

The names of eleven Candidates for admission into the Society were read.

The following papers were then read:—

"On an Improvement in Aneroid Barometers." By the Hon. RALPH ABERCROMBY, F.M.S. (p. 87.)

"On Meteorology in India in relation to Cholera." By Col. J. PUCKLE, M.S.C. (p. 89.)

" On Sixteen Months' Rain at Bristol." By WILLIAM F. DENNING, F.M.S.

In the sixteen consecutive months ending (and including) November, 1875, the nmense surplus of rain over the average yield has been without parallel in this ɔcality, and the subjoined Table of the monthly quantities registered at this tation in the SW of England may be of some use for comparison with obser-ations at other places. The annual average is slightly more than 32 inches, and t will be noticed that during the sixteen months the aggregate yield was nearly ouble that quantity:—

Months. 1874-5.	Rain 1874-5.	Average of 20 years.	Above (+) or Below (—) Average.	Greatest Fall in 24 hours.	Date of Fall.	Days of Rain.
	Inches.	Inches.	Inches.	Inches.		
August	4·700	3·250	+1·450	1·135	7th	18
September	7·026	3·127	+3·899	1·129	3rd	21
October ..	3·742	3·499	+0·243	1·105	6th	18
November ..	2·458	2·351	+0·107	0·918	28th	15
December	3·533	2·650	+0·883	1·123	8th	16
January ..	5·119	3·291	+1·828	0·765	1st	25
February ..	2·277	1·984	+0·293	0·847	6th	12
March	1·416	2·123	—0·707	0·588	7th	11
April	2·099	2·035	+0·064	0·800	7th	11
May ..	3·108	2·424	+0·684	0·618	6th	16
June	3·902	2·658	+1·244	0·701	13th	16
July	5·358	2·656	+2·702	2·552	14th	15
August	1·429	3·250	—1·821	0·399	8th	13
September	4·056	3·127	+0·929	0·887	21st	17
October ..	7·015	3·499	+3·516	0·950	9th	24
November	5·983	2·351	+3·632	1·314	13th	20
16 months	63·221	44·275	+18·946	—	—	268

This unprecedented excess reaches 19 inches (nearly) in the sixteen months. There was a considerable deficiency in March and August, 1875, while each of the remaining fourteen months shows a surplus, and, in most cases, a large one. There were two remarkable periods, equal in duration, of very heavy and frequent rains, as under:—

Nine weeks ending October 7th, 1874 ..... 13·521 inches.
Nine weeks ending November 20th, 1875..... 15·942 inches.

Thus 29½ inches of the large total given in the Table were measured within the eighteen weeks specified. The mean daily fall during the sixteen months was 0·122 inch, which, compared with the average 0·086 inch, shows an excess of 0·036 inch. Thus the diurnal surplus (on 518 days) equalled the 1-28th part of an inch.

In December, 1875, the fall was 1·386 inch, being 1·264 inch below the average. For the whole year the figures were 43·148 inches, which exceeds the amount registered in the extremely wet year 1872, and is 11·100 inches above the average. More rain fell in each of the months, July, October, and November, than had previously been recorded since 1853. I have no observations of rain-fall made in this district anterior to that year.

The averages given above are derived from twenty years' (1853-72) observations at Clifton, by Dr. G. F. Burder, F.M.S.

The gauge is on the ground, and emptied every morning at 9 a.m. The situation here is about 200 feet above sea level.

The Meeting was then adjourned.

Donations received from January 1st to March 31st, 1876.

Presented by Societies, Institutions, &c.

Adelaide	South Australian Institute	The depth of rain in Adelaide in each day from January 1, 1839, to October 31, 1874; and also the total Rainfall in each year from 1839 to 1873.
	" " "	The average monthly rainfall in Adelaide, Melbourne, and Sydney; and also the maximum and minimum rainfall in each month. For Adelaide from January 1, 1839, to October 31, 1874; for Melbourne from January 1, 1855, to July 31, 1874; for Sydney from April 1, 1840, to July 31, 1874.
Brussels	Observatoire Royal.....	Annales, November, 1875, to February, 1876.
	" "	Annales, Resumé, 1874 and 1875.
Budapest.....	Konigl. Ungarische Central-Anstalt für Meteorologie und Erdmagnetismus	Jahrbuch, Band III, 1873. By Dr. Guido Schenzl, Director.
Calcutta	St. Xavier's College Observatory	Meteorological Register, July to December, 1875. By Rev. E. Francotti, S.J., Director.
Copenhagen ..	Danske Meteorologiske Institut	Bulletin Météorologique du Nord, December, 1875 to February 29, 1876.
	" "	Annuaire Météorologique pour l'année, 1874. By Captain N. Hoffmeyer, Director.
Cracow	K. K. Sternwarte	Meteorologische Beobachtungen, November, 1875, to February, 1876. By Dr. F. Karlinski, Director.
Edinburgh	Royal Society	Proceedings, Vol. VIII., Nos. 90-92.
	Scottish Meteorological Society	Journal, Nos. XLVII. and XLVIII.
Fiume	I. R. Accademia di Marina	Meteorological Observations, October 1875 to January, 1876.
Greenwich	Royal Observatory	Results of the Magnetical and Meteorological Observations made during 1873. By Sir G. B. Airy, K.C.B., Astronomer Royal.
Hamburg	Deutsche Seewarte	Wetterbericht, from February 27th. By Dr. G. Neumayer, Director.
Kew	Observatory	Report for the year ending October 31, 1875. By the Kew Committee.
Klagenfurt	Sternwarte	Meteorologische Beobachtungen, November, 1875, to January, 1876. By M. Seeland, Director.
London	Art Union	Report of the Council for the year 1875.
	Association of Municipal and Sanitary Engineers and Surveyors	Proceedings, Vol. I., 1873-4. By Lewis Angell.
	General Register Office ..	Weekly Return of Births and Deaths, 1875, No. 52; 1876, 1-12.
	" "	Quarterly Return of Marriages, Births, and Deaths, December 31, 1875.

London	General Register Office ..	Annual Summary of Births, Deaths, and Causes of Death in London and other large cities, 1875.
		By the Registrar-General.
	Meteorological Office	Daily Weather Reports and Charts.
	,, ,,	Quarterly Weather Report, 1874, Part II.
	,, ,,	Hourly Readings from the Self-Recording Instruments at the Seven Observatories in connection with the Meteorological Office, June, 1874, and July, 1875.
	,, ,,	Annuaire Météorologique de l'Observatoire de Paris, 1872.
	,, ,,	Observations Météorologiques faites à Nijné-Taguilsk (Monts Oural), Gouvernement de Perm, 1846-1849.
		By the Meteorological Committee.
	Royal Astronomical Society	Memoirs, Vol. XLII., 1873-1875.
	Royal Society	Proceedings, Vol. XXIV., Nos. 165-167.
Manchester ..	Literary and Philosophical Society	Proceedings, Vol. XIV. Nos. 11-13.
	Manchester and Salford Sanitary Association ..	Health and Meteorology of Manchester. Nos. 3-41, 127-178, 201-544. New Series, Nos. 1-116, 118-130.
	,, ,,	
Melbourne	Government Observatory	Annual Report of the Committee for 1874.
		Monthly Record of Results of Observations in Meteorology, Terrestrial Magnetism, &c., June to August, 1875.
	,, ,,	Results of ditto for the year 1874.
		By R. J. Ellery, F.R.S., Government Astronomer.
Milan	R. Specola Astronomica di Brera.	Osservazioni Meteorologische, May to December, 1875.
Moncalieri	Osservatorio del R. Collegio Carlo Alberto	Bullettino Meteorologico, Vol. IX., No. 10, to Vol. X., No. 1.
	,, ,,	Osservazioni Meteorologische, January and February.
		By Padre F. Denza, Director.
Oxford.....	Radcliffe Observatory....	Observations of Shooting Stars, 1873.
	,, ,,	Results of Meteorological Observations, 1873.
		By Rev. R. Main, F.R.S., Radcliffe Observer.
Paris.....	Observatoire de Montsouris	Annuaire Météorologique et Agricole, 1876.
	,, ,,	Bulletin Mensuel, Nos. 48-50.
	Observatoire National ..	By M. Marié Davy, Director.
	,, ,,	Bulletin International.
		Atlas Météorologique pour les années 1872, 1873, et 1874.
	Société Météorologique de France	By M. U. J. Le Verrier, Director.
		Nouvelles Météorologiques, December, 1875, to February, 1876.
Pesara.....	Osservatorio Meteorico e Magnetico Valerio	Bullettino Mensile, Series II., Vol. I., July and August, 1875.
		By Luigi Guidi, Director.
Philadelphia ..	American Philosophical Society	Proceedings, No. 95.
Rome	Osservatorio del Collegio Romano	Bullettino Meteorologico, December, 1875, to February, 1876.
		By Padre A. Secchi, Director.
St. Petersburg	Central Physical Observatory	Repertorium für Meteorologie, Band IV.
		By Dr. H. Wild, Director.
Stockholm	Royal Swedish Academy of Science	Meteorologiska Iakttagelser i Sverige, 1871 and 1872.
Stonyhurst....	Observatory	Results of Meteorological and Magnetical Observations, 1873 and 1874.
		By Rev. S. J. Perry, F.R.S., Director.

Sydney	Government Observatory	Meteorological Observations, August and September, 1875. By H. C. Russell, B.A., F.R.A.S., Government Astronomer.
Toronto	Education Office	Journal of Education, December, 1875, to February, 1876. By Rev. E. Ryerson, D.D,, Superintendent.
	Magnetic Observatory ..	Monthly Meteorological Register, January 1st to December 31st, 1875.
	,, ,,	General Meteorological Register for the year 1875. By G. T. Kingston, M.A., Superintendent.
Upsala.....	Observatoire de l'Université	Bulletin Météorologique Mensuel, July to September, 1875. By Dr. H. H. Hildebrandsson, Director.
Vienna	K. K. Centralanstalt für Meteorologie und Erdmagnetismus	Beobachtungen, November, 1875, to January, 1876. Dr. C. Jelinek, Director.
	Oesterreichische Gesellschaft für Meteorologie	Zeitschrift, Band XI., Nos. 1-6.
Washington ..	Smithsonian Institution	Annual Report of the Board of Regents for 1874. By Prof. J. Henry, Secretary.
	War Department.....	Daily Bulletin of the Signal Service, U. S. Army, with the Synopses, Probabilities, and Facts, March and May, 1873.
	,, ,,	Monthly Weather Review, December, 1875, to February, 1876. By Brigadier-Gen. A. J. Myer, Chief Signal Officer.
Wellington	Registrar-General's Office	Statistics of the Colony of New Zealand for the year 1874. By W. R. E. Brown, Registrar-General.

Presented by Individuals.

Aldridge, E. G.	The Climate of Eastern and South-Western England, Chapter iii. Extremes of Temperature. By E. G. Aldridge. Letter to the 'Torquay Directory.'
,, ...	The Climate of the South of Devon and its Influence upon Health. By Dr. T. Shapter.
Brooke, C. M.A., F.R.S ...	On the Automatic Registration of Magnetometers and Meteorological Instruments by Photography. Parts III. and IV. By Charles Brooke, F.R.S.
,, ...	Analyse des Hypothèses anciennes et modernes qui ont été émises sur les Eclairs sans Tonnère par un ciel parfaitement serein ou dans le sein des nuages, accompagnée d'une description des Eclairs sans Tonnère. Par A. Poëy.
,, ...	Sur divers signes sensibles du Mouvement diurne de la Terre, par M. Léon Foucault.
Buchan, A., M.A., F.R.S.E.	On the Diurnal Oscillations of the Barometer. Part I. By Alexander Buchan, M.A., F.R.S.E.
Cadle, C.....	Rainfall for 1875 at Newark House, near Gloucester. (MS.)
Clift, H. A.....	The Weather at Harbour Grace, Newfoundland, November 1875 to February 1876. (MS.)
Curtis, J.	Meteorological Summary for Manchester for 1875. By J. Curtis.
,, ...	Meteorological Memoranda for Manchester for the two weeks ending March 9th. By J. Curtis.
Denning, W. F.....	Meteorological Sketch of the year 1875 at Bristol. By W. F. Denning.
Drach, S. M.	The Wonderful Winter in the United States, 1875-6.

Dunlop, W. H.	Results of Meteorological Observations made at Annanhill, Kilmarnock, Ayr, December 1875 to February 1876.
,, ...	Abstract of ditto, 1875.
,, ...	Rainfall at ditto, 1875.
Ericsson, J.	The Difference of Thermal Energy transmitted to the Earth by Radiation from different parts of the Solar Surface. Parts I. and II. By J. Ericsson.
Forbes, A.	Meteorological Summary, Culloden, January and February (MS.).
Hankinson, R. C.....	Summary of Meteorological Observations taken at Red Lodge, Southampton, December 1875 to February 1876. (MS.)
Higgs, Rev. W., LL.D. ..	The Telegraphic Journal and Electrical Review, Nos. 70-75.
Hildebrandsson, Dr. H. H.	Sur la Trombe près de Hallsberg le 18 Août 1875. Par H. Hildebrand Hildebrandsson.
Hoskins, S. E., M D., F.R.S.	Meteorological Observations taken at Guernsey, December 1875 to February 1876.
Lemström, M. Selim	Sur la Théorie de l'Aurore Boréale à propos de quelques Phénomènes observés dans des tubes de Geissler, par M. Selim Lemström.
,, ...	Supplement to ditto.
Loomis, Prof. E.	Contributions to Meteorology, being results derived from an examination of the U.S. Weather Maps and other sources. By Elias Loomis. Fourth Paper.
McLandsborough J.F.R.A.S	Meteorology of Bradford for 1875.
,, ...	Record of a Year's Rainfall at the Exchange, Bradford, in 1875.
Merrifield, J.Ph.D., F.R.A.S.	Meteorological Summary, Plymouth 1875.
Michel, R. F.	Note sur la méthode à employer pour l'essai des conditions de conductibilité des paratonnerres; par M. R. Francisque Michel.
Miller, S. H., F.R.A.S. ..	The Fenland and Eastern Counties Meteorological Circular and Weather Report, January to March.
Murray, A. E.	The Meteorology of Hastings, 1875. Paper read before the Hastings Philosophical and Historical Society.
,, ...	Meteorological Tables and Curves, Hastings, 1875. (Photographs.)
Nelson, R. J.	Meteorological Observations made at Kendal during 1875.
Ommanney, Adm. E., C.B., F.R.S.	Log kept on board H.M.S. 'Eurydice,' in the White Sea, May 27th to October 29th, 1854. (MS.)
Pastorelli, F.	Catalogue of Standard Meteorological Instruments. Part I.
Punnett, W. C.	The Summary of a Meteorological Journal kept by W. C. Punnett at St. Mary's, Tunbridge, during 1875.
Quetelet, E.	Eléments Climatologiques de la Ville de Bruxelles pendant la période décenniale 1864-1873, par M. Ern. Quetelet.
,, ...	Mémoire sur la Temperature de l'air à Bruxelles 1833-1872. (Supplement); par M. Ern. Quetelet.
,, ...	Notice sur l'Observatoire Royal de Bruxelles.
,, ...	Sur la Période de Froid du Mois de Decembre 1875. Par M. Ern. Quetelet.
Robinson, Rev. T.R., D.D., F.R.S.	On the Theory of the Cup Anemometer and the determination of its Constants. By the Rev. T. R. Robinson, D.D.
Scott, W.	Climate; with special reference to the Climate of North Staffordshire. Paper read before the North Staffordshire Naturalists' Field Club.
Silver, S. W.	The Colonies, Nos. 203-207.
Sopwith, T., M.A., F.R.S...	An Account of Meteorological and Physical Observations made in five Balloon Ascents in the year 1863. By James Glaisher, F.R.S.
,, ...	Remarks on the Weather for the Quarter ending September 30th, 1865. By James Glaisher, F.R.S.
,, ...	Board of Trade Charts, showing Wind, Currents, Magnetic Variation and Dip, Sea Temperature and Prevalence of Rain. Nos. XIX. to XXII. February; XXXI. to XXXIV. May; XLIII. to XLVI. August; and LV. to LVIII. November.
,, ...	Do. Trade Wind Chart of the North and South Atlantic.

Sopwith, T., M.A., F.R.S.	Board of Trade Wind Charts of the North and South Atlantic, North Pacific and Indian Oceans; South and East Coasts of Africa, Coasts of Central America and Brazil, and the Eastern and Western Vicinities of Cape Horn.
,, ...	Contributions to a knowledge of the Phenomena of the Zodiacal Light. By Prof. C. Piazzi Smyth.
,, ...	On the Total Solar Eclipse of 1851. By Prof. C. Piazzi Smyth.
,, ...	Meteorological Register kept by the Earl of Gifford in his yacht 'Fair Rosamond.'
,, ...	The Magazine of Natural Philosophy. Edited by E. J. Lowe, F.R.A.S.
,, ...	Resúmen de las Observaciones Meteorológicas efectuadas en el Real Observatorio de Madrid, durante el ano 1864.
Symons, G. J.	Symons's Monthly Meteorological Magazine. January to March.
,, ...	Report of the Astronomer to the Marine Committee, Mersey Docks and Harbour Board, 1868.
,, ...	Des Climats propres aux Malades, ou Etude comparée de l'action préventive et curative du Climat de Pau et des Climats de Montpellier, Hyères, Nice, Rome, Pise, Florence, Biarritz, &c. Par Sir Alexander Taylor, M.D.
,, ...	Das Gesetz der Stürme in seiner beziehung zu den Allgemeinen Bewegungen der Atmosphäre. Von H. W. Dove.
,, ...	Der Kreislauf des Wassers auf der Oberfläche der Erde. Von H. W. Dove.
,, ...	Grundzüge der Schlesischen Klimatologie. Von Dr. J. G. Galle.
,, ...	Supplement zur klimatographischen uebersicht der Erde. Von Adolf Mühry, M.D.
,, ...	Systematischer Grundriss der Atmosphärologie. Von W. A. Lampadius. (1806.)
,, ...	Waarnemingen in de Oost-Indische Bezittingen van Nederland. (Observations aux Indes Orientales.)
,, ...	Meteorologiske Iagttagelser paa fern Telegrafstationer ved Norges Kyst. Reducerede og Sammenstillede af J. J. Astrand (Forste og Anden Aarang).
Tarbottom, M.O., F.G.S.	Meteorological Observations taken at Nottingham, 1875.
,, ...	Registers of Rainfall, collected at 183 and 223 feet above Sea Level, at Nottingham, from January 1st to December 31st, 1875.
,, ...	Rainfall Registers collected from Stations on the Watershed of the river Trent, above the town of Nottingham, from January 1st to December 31st, 1875.
Tripe, J. W., M.D.	Weekly Return of Births and Deaths, 1857 to 1862.
The Editor.....	'Medical Examiner,' No. 1.
,, ...	'Nature,' Nos. 323-335.
,, ...	'Public Health,' Vol. IV., Nos. 1, 2, 4 to 6.
,, ...	'The Academy,' Nos. 191-203.
,, ...	'The Exporter,' Vol. V., No. 40.
,, ...	'The Medical Press and Circular,' February 23rd.
,, ...	'The Sanitary Record,' Nos. 84-91.
,, ...	'The Trade Marks Gazette.' Nos. 1, 2, 4.
Turtle, L.	The Weather at Aghalee, Lurgan, during December 1875 and January 1876.
,, ...	Review of ditto during 1875.

QUARTERLY JOURNAL

OF

THE METEOROLOGICAL SOCIETY.

VOL. III. No. 19.

X. *On the Rhé-Electrometre of Marianani; A new instrument for observing and recording the passage of Electric Discharges between the Atmosphere and the Earth.*

By ROBERT JAMES MANN, M.D., F.R.A.S.

[Received February 15th.—Read March 15th, 1876.]

THE instrument which is described in this paper is constructed by Mons. De Vos, of the Rue des Croisades, Brussels, under the suggestions and plans of Mons. L. H. F. Melsens, Professor of Physics and Chemistry at the Government School of Veterinary Medicine at Brussels.

The apparatus essentially consists of a coil of copper wire, carrying a magnetised needle traversing upon the point of a vertical axis immediately above the coil, and having a moveable bar of iron thrust into the interior of the coil, so that it can be magnetised when an electrical spark of high tension passes through the coil. The instrument is intended to be so placed that the magnet rests north and south under the natural magnetism of the earth, and the coil and contained iron bar then cross at right angles to the magnet from east to west. If, however, an electric spark passes through the coil, the iron bar is immediately magnetised, and deflects the pivoted magnetic needle from its position of ordinary rest, the deflection of the north point of the needle being towards the east or the west, according to the direction in which the coil of copper wire is turned, and in which the electrical discharge is made to pass through the coil. The deflection is also more or less, accordingly as the spark is more or less intense; and a scale of degrees inscribed upon a card ranged between the needle and the coil gives the means of estimating the amount of the deflection. The half of the magnetised needle which traverses towards the north point of the horizon under the natural magnetism of the earth is distinguished by being made of blue steel. The instrument is mounted upon a broad brass bracket to enable

it to be fixed from the wall of a telegraph office in a horizontal position, but it has also levelling screws to enable it to be placed upon a table for cabinet experiments. There is further a contrivance by which the needle may be raised up on standards some distance above the coil, when the glass of the dial has been removed, so as to enable the instrument to be adjusted for the use of strong electrical discharges, which would exert too intense an action upon the magnetised needle if it remained in the usual position of close approximation to the coil.

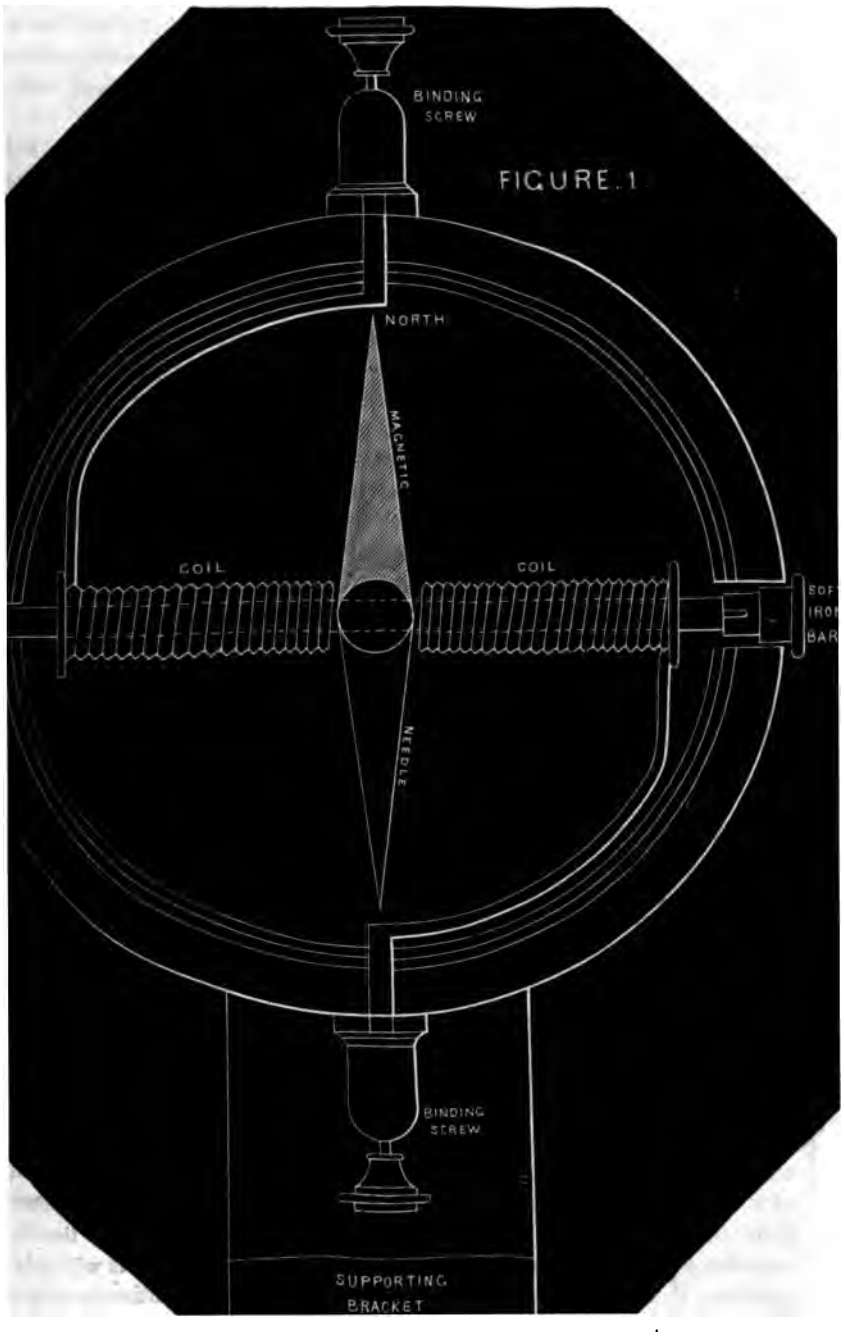
The instrument is so sensitive that it gives immediate indication when only a slight spark is passed from an electrophorus, a frictional electrical machine, or a Leyden jar, through the coil. It is, however, indispensable to its action that there shall be the passage of a spark. The Holtz machine without its cascade jars does not produce magnetisation in the iron bar, or deflection in the magnetised needle, unless under the accidental circumstance of a minute spark passing because the wire of the coil is withdrawn from the contact screw before putting the two spheres of the positive and negative conductors of the machine in contact, when there is immediately a deflection.

When the deflection of the needle has once been produced, that deflection endures until the iron bar is removed from the coil, and is therefore to that extent a permanent record. The magnetisation of the iron bar continues for months. Fresh neutral bars are therefore kept on hand to replace immediately any one that has been magnetised by the passage of a spark. But the magnetised bar can be returned into its neutral state, and be so made fit for being employed again, by being strongly heated. It, however, sometimes has to be heated several times in succession before the due neutralisation is secured, and Professor Melsens has found some difficulty in getting good neutral iron bars prepared from ordinary iron of commerce. In his first suggestion for the construction of the instrument, he spoke of the iron core as "a bundle of iron wire, an iron cylinder, or what seems better still with a helix about ten centimetres long, the half of a large steel knitting needle annealed or softened, and absolutely deprived of all magnetism."* He afterwards explained that all the commercial iron wire that he came across sufficiently preserved its magnetism on the passage of a spark to serve the purpose of the core, and that the adoption of the tempered and annealed steel knitting needle was consequently not necessary. He found it much more difficult to get iron that could be rendered absolutely neutral by heat, than to find iron sufficiently prone to acquire magnetisation from the spark.

In Marianani's instrument the coil is formed of copper wire 0·0012 of a metre, or about 1·2 millimetres in diameter (wire No. 7, Paris gauge). 1·45 metres of wire in length are made into a coil of 48 spires, which are wound round a tube either of pasteboard or glass. The iron bar which is introduced

* "Un faisceau de fil de fer, un cylindre de fer, ou ce qui m'a paru preferable, l'helice n'ayant qu'environ dix centimetres de longuer, la moitié d'une grosse aiguille à tricoter en acier; ce barreau peut être recuit ou trempé, mais il doit être absolument privé de magnétisme."

ıto the interior of this tube is 2·40 millimetres ($\frac{92}{1000}$ of an inch) in diameter.



MARIANANI'S RHE-ELECTROMETRE (EXACT SIZE).

One end of the iron bar is flattened to secure its adjustment into the proper position in the coil, and the other end is clipped by a brass head for convenient removal of the bar when it has to be withdrawn from within the coil. The sketch in Fig. 1 illustrates the construction of the instrument, with all its parts on the exact scale adopted.

This instrument is being gradually introduced into the offices of the Public Telegraphic Service of Belgium. It is placed permanently in the course of the earth wires which are used as lightning rods, and which are connected with the line circuit through the intervention of a sheet of paper that suffices to confine continuous currents, but allows sparks or induction currents to leap through. The paper is then either stained or perforated by the passage of the spark. When the Rhé-electrometre is employed upon the earth wire there is a manifest deflection of its needle whenever the paper indicates the passage of a spark; but the needle records not only the fact of the passage, but the kind of the discharge (whether positive or negative), and to a considerable degree also its intensity, measured by the angular arc of the deflection, a return of all the facts of the deflection of the needle of the instrument, of the perforation of the paper, and of the occurrence of electrical manifestations of a storm character, are required to be made to the Chief of the Telegraphic Departments. Professor Melsens' assumption is, that by the general employment of these instruments upon extended lines of telegraphic communication very valuable practical information will be obtained regarding the specific character of electrical disturbance in the atmosphere, and the distribution and rate of movement of thunderstorms. The instrument is already in use at the offices of Malines, Gouvain, Bruges, and Courtray. At these places the needles of instruments have been several times affected by storms. The needles have been sometimes deflected towards the east, and sometimes towards the west. Actual discharges of lightning produce immediate and brisk deflections of the needle, which are often neutralised by subsequent discharges. The deflected needle is sometimes recalled sharply to the zero point, but sometimes after having been suddenly deflected to 90°, it returns very gradually and slowly to zero.

No fixed standard for the estimation of the deflecting force has yet been contrived, but it forms part of Professor Melsens' design to accomplish this hereafter by experimental investigations. The raising of the magnetic needle to varying distances above the coil, it is conceived, will furnish one of the means by which this object may be ultimately secured.

Professor Melsens proposes that this little apparatus shall be used in connection with the ordinary lightning conductor erected for the protection of buildings, as well as in connection with the lines of telegraphic communication. In the case where several distinct stems are employed for the Paratonnerre, as in the instance of the Hotel de Ville at Brussels, it will only be necessary that one of these stems shall have a break of continuity with the insertion of a sheet of paper into it, and that the Rhé-electrometre shall be placed in continuous circuit with the divided ends of that rod, as shown in the sketch of figure 2. If one large Paratonnerre is used instead of

several, the Rhé-electrometre must be fixed on some convenient part as a devious circuit, formed of a loop of fine wire set off from the main line of the conducting rod, as shown in the sketch of figure 8. The experiments of Professor Melsens upon the diffusion of an electrical discharge through the substance of a continuous conductor, show that this divergent offset or loop would have a sufficient share of the transmitted force on the passage of a lightning discharge through the Paratonnerre to give a manifest record; the experiments hitherto made with the Rhé-electrometre by means of the electrophorus and frictional electrical apparatus, give good ground for the assumption that that share, under the circumstance of all ordinary lightning discharges through the Paratonnerre, would be ample to produce such indication as is required. Professor Melsens, however, proposes that there shall be Observatory Paratonnerres erected especially for investigating the electrical conditions and changes of the atmosphere, in which three distinct lightning rods shall be carried up from one common communication with the earth. Of these lightning rods No. 1 is to have a Rhé-electrometre attached, with a broken chasm and the sheet of paper interpolation, as represented in figure 2. The electrometre on this interrupted conductor will give indications of instantaneous discharges passing between the atmosphere and the earth. No. 2 is to have an ordinary galvanometer attached to a divergent loop upon an uninterrupted conductor, upon the same plan as that represented for the Rhé-electrometre in figure 8; this will give indications of the passage of derived continuous cur-

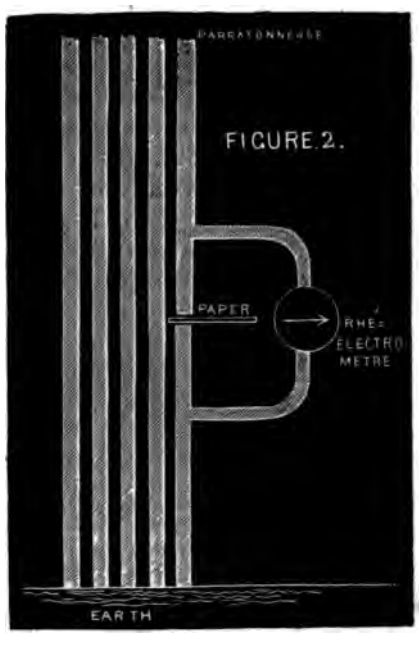


FIGURE 2.

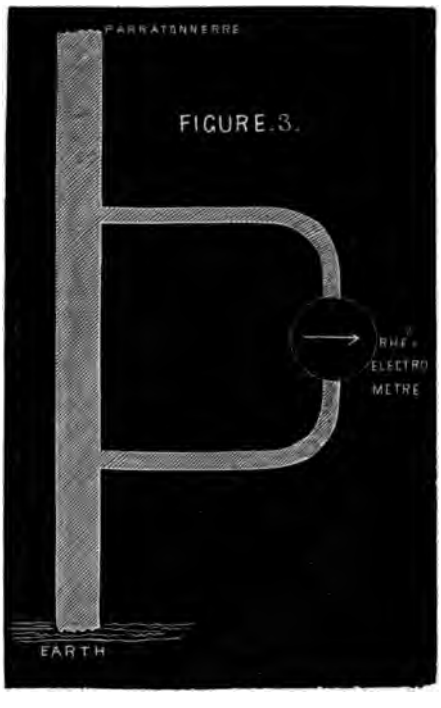


FIGURE 3.

rents between the atmosphere and earth. No. 3 is to have a galvanometer for indicating continuous currents, placed in circuit upon an interrupted rod, with a provision for making earth contact either from above or from below the galvanometer by means of a commutator, so as to enable the coil to be thrown into or out of the circuit at will.

One important point in regard to this little instrument is its simplicity and cheapness. It is supplied by Mons. de Vos for the service of the telegraphs in Belgium, for wholesale quantities, at a cost of about ten francs for each instrument. Professor Melsens very strongly believes in the capacity of this simple and inexpensive piece of apparatus to do useful work in the direction which he has indicated; but he also desires to have its usefulness and capabilities put to a further test by practical electricians and telegraphists.

DISCUSSION.

Mr. BROOKE said that the portion of the current which is diverted through the shunt will be in the ratio of the resistance of the portion of the conductor between the points at which the shunt is attached, to that of the shunt itself. Might it not be worth while to use steel needles, which might be demagnetised by passing a shock from a Leyden jar through the coil? If such a needle were employed instead of a bar of iron, it might give some indication of the strength of the shock by the amount of magnetism retained in it.

Mr. C. V. WALKER said that the instrument was quite new to him. The construction was interesting; but it was not easy to see to what extent the instrument with its soft iron bar would be useful, unless, indeed, the observation were taken directly after the discharge. Electricity from the atmosphere collected by telegraph wires, as seems to be proposed, is very different from earth currents collected by plates buried in the ground.

Mr. ELLIS said that the electrical apparatus at the Royal Observatory was at present rather old-fashioned, consisting of pairs of straws, gold leaf electrometer, galvanometer, &c. for eye observations only; but the Astronomer Royal hoped shortly to add a Thomson's electrometer, similar to that in use at the Kew Observatory, with the object of obtaining by photography a continuous record of atmospheric electricity. The earth currents were quite different to those that would be obtained from the instrument described by Dr. Mann, which appeared to be for atmospheric electricity.

Mr. WHIPPLE failed to see in what this instrument differed from a galvanometer. At Kew there was an old Ronalds' instrument which was adapted for photographic registration. The one exhibited could not be made to give reliable numerical results. He did not think that soft iron could be completely demagnetised. Thomson's instrument is an admirable electrical recorder, and gives a continuous record; the intensity could also be obtained by joining up a number of Groves's cells.

Dr. MANN explained that Professor Melsens' instrument is intended to be read as immediately as possible after any deflection of the magnet; but that it only marks sparks or instantaneous discharges, and not currents. In the telegraph offices it is attached to the earth wires employed as lightning conductors for the protection of the apparatus. No novelty whatever is claimed for its attachment to a Paratonnerre in the form of a shunt. Professor Melsens simply desires for it a trial as a ready, cheap, and efficient apparatus for marking the occurrence and nature of earth discharges.

XI. *On the Variation of Errors in Hydrometers.* By R. STRACHAN, F.M.S. (Communicated by R. H. SCOTT, F.R.S., Director of the Meteorological Office.)

[Received February 14th.—Read March 15th, 1876.]

DURING the last twenty years a large number of observations on the Specific Gravity of the Oceanic Waters have been made by the observers for the Meteorological Office with glass hydrometers lent by the Office for the purpose. The makers of these instruments contracted to supply them subject to their passing a test examination at the Kew Observatory. The rule for rejection is thus defined: "Reject all in which the largest error at any point is greater than one division of the scale (equal to ·001 sp. g.), or in which any space of ten divisions is more than 0·6 of a division wrong." Certificates of corrections have been supplied for accepted instruments by the Kew Observatory, and the observations have been corrected accordingly for instrumental errors. Many among the earliest of these instruments supplied are still extant, notwithstanding constant transfer from ship to ship. It became, therefore, desirable to ascertain whether such instruments had undergone alteration in their indications from wear, use, change of form, or other cause. Accordingly, three hydrometers were reverified at the Kew Observatory with the utmost care, in order that they might be used as standards in the Meteorological Office for comparing those returned from service at sea.

The following are the two sets of corrections furnished from Kew for these standards:—

Hydrometer.	Correction for Scale Error.				
	At 0.	At 10.	At 20.	At 30.	At 40.
May 1859.					
No. 453	0·0	—0·1	0·0	—0·2	—0·3
455	0·0	± ·4	± ·5	± ·5	± ·6
456	0·0	± ·6	± ·6	± ·7	± ·6
January 1871.					
No. 453	—0·3	—0·3	—0·3	—0·4	—0·4
455	— ·2	± ·1	± ·2	·0	± ·1
456	— ·3	± ·2	± ·2	+ ·3	± ·1

The latest corrections have been applied to the standards when making comparisons, and the corrections so found for other hydrometers have been recorded.

Let K represent the correction given for a hydrometer at the Kew Observatory, and M that found at the Meteorological Office after an interval of years. Then $M - K = \pm V$ is the variation of the correction, which, if +, is due to a deposit of salt or dirt on the instrument or to contraction of

its volume, or to both causes combined; and, if —, is due to the wear of the instrument or its enlargement of volume, or to both causes combined. The hydrometers under consideration were all of them made of glass, and no symptoms of wear were discernible, and they were always cleaned for comparisons with the standard; consequently this investigation has merely to decide whether they undergo enlargement or shrinkage by use and age assuming that the corrections have been carefully ascertained. There is however, the liability of the scale slipping; but, unless this has been evident, must somewhat affect the result. Only the corrections for those instruments of which the scales had undoubtedly shifted have been rejected. The scale if it shifts at all, generally slips down the stem, but instances sometimes occur of it having slipped up the stem and lodged there. The following are the results obtained:—

Part of Scale compared.	Variation.			Interval of Years.	Number of Instruments tried.
	Mean.	+ Extreme.	— Extreme.		
0	—0·2	+1·6	—1·2	2	11
,,	— ·1	+2·0	— ·9	4	104
,,	+ ·3	+1·7	—1·0	6	27
,,	— ·5	+ ·7	—2·5	12	10
,,	— ·2	— ·1	— ·3	14	3
,,	+ ·6	+1·6	—1·0	16	17
,,	·0	+ ·9	—1·1	18	26
,,	+ ·1	+1·3	—1·5	20	18
15	+ ·2	+ ·5	— ·1	1	2
,,	+ ·3	+ ·4	·0	4	5
,,	+1·1	..	..	13	1
,,	+ ·5	..	..	17	1
24	+ ·1	+ ·8	— ·4	1	11
,,	·0	+1·7	— ·6	4	9
,,	— ·1	+1·4	—1·4	5	7
,,	— ·4	— ·2	— ·7	13	2
,,	+ ·2	+ ·5	— ·2	15	4
,,	+ ·4	..	..	20	1
27	— ·4	— ·1	— ·8	2	2
,,	+ ·8	..	..	15	1
35	+ ·2	+1·2	— ·6	2	6
,,	— ·3	+ ·8	—1·0	3	9
,,	+ ·7	+1·2	+ ·3	13	5
,,	+ ·2	+ ·7	— ·1	16	6
,,	+ ·3	+2·0	—1·1	17	4
40	+ ·2	+ ·7	— ·3	2	2
,,	+ ·8	+1·3	— ·1	14	3
,,	+ ·6	+ ·8	+ ·4	16	2
Mean and extremes	+ ·2	+2·0	—2·5	Of all	
,,	+ ·3	+2·0	—2·5	12 years and over	
,,	·0	+2·0	—1·4	6 · ,, under	

The mean variation is only + 0·2, indicating slight shrinkage, but practically it tends to show that these instruments undergo no material change in weight or volume. The extreme variations range from + 2·0 to — 2·5, or an extreme error of 4·5 divisions. It is scarcely possible that these extremes can ever be due to mistakes in comparisons; but it is very probable that the largest are owing to shifting of the scales, which cannot always be detected by simple inspection, and hence the necessity for trying these instruments after their return from a voyage. In the Table it will be noticed that the *minus* extremes exceed in magnitude the *plus* extremes only seven times. The tendency for the scale to slip down must certainly be greater than that for it to lodge above its original place of fixture, and this may account for the extreme *plus* variations being generally larger than the extreme *minus* variations. It is essential that the makers of hydrometers should so fix the scales that they cannot possibly shift. The practice of fastening the ivory or paper scale in the cylindrical stem by common sealing wax at its lower end is not safe, because if the wax gets soft there is space above and below into which the scale may shift by a jerk. A similar objection applies to wax for closing the neck of the loaded bulb, for it is apt to get loose or soft, and the small shot or mercury used for loading gets loose and fouls the interior of the nstrument and the scale. With the object of removing these defects, namely, melting of wax at high temperature and the shifting of the scale, Mr. J. J. Hicks has recently substituted for the ordinary transparent glass tem with enclosed scale, a white opaque stem of enamelled glass upon which he divisions and figures are indelibly marked in black. It is to be hoped hat the like annoyance may not be experienced with these so-called indelible narks as with the black division marks of thermometers, by their washing out.

DISCUSSION.

Mr. PASTORELLI said that the glass bulb of the hydrometer which is mounted a few days after it is blown is liable in time to diminish in size, consequently its ndications will always be lower, never higher, than the true specific gravity. There are three sources of errors that arise in making hydrometers, viz.:— 1, The Stem; 2, Temperature; 3, Dividing. 1. It is difficult, if not practically impossible, to make glass cylindrical stems accurately uniform throughout their length; in low range instruments the errors will be small, but in those of a high range, from 1,000 to 1,700, he had known them to be 5 or more degrees. 2. The temperature of the glass bulb is rarely, if ever, taken into consideration by the workman, and as there may be a difference of 20° between it and the test fluid at 60° in summer and winter, a small error must thereby arise. 3. The errors of dividing in low range instruments are generally small, but in those of a high range, up to 1,700 specific gravity, two or three degrees may be observed.

Mr. WHIPPLE said that they had at Kew a large vessel of water constantly kept at a temperature of 60° when testing hydrometers. At one time it was only considered necessary to give a correction of 0·5.

Mr. C. HARDING said that the system employed for the frequent testing of the hydrometers would detect any serious change of error; if not, the careful scrutiny to which the observations of the Specific Gravity of Sea Water are subjected would detect any such error. It was suggested at the Maritime Conference, held in London in 1874, that hydrometers should be made with more open scales, ranging in accordance with the specific gravities of water in which they are immersed.

XII. *On the Deduction of Mean Results from Meteorological Observations.* By Dr. L. F. Kamtz.

(Translated from Kämtz' 'Repertorium für Meteorologie,' published by the Imperial Geographical Society of St. Petersburg, Vol. I. p. 107, by J. S. Harding, F.M.S.)

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It is not possible for the human mind to survey at a glance the series of Meteorological conditions which have occurred during a long period; certain resting-points are required to enable it to embrace shorter intervals,—like as in the consideration of a landscape, a complete representation can only be obtained by selecting different positions from which the individual parts are viewed, and around which the rest are, as it were, grouped. These resting points in meteorology are furnished by the means, around which the individual observations arrange themselves according to laws which must be more closely determined for certain regions.

If, for instance, we wish to deduce the mean temperature of a single hour in a certain month, the arithmetical mean of all observations made at this hour is taken. By so doing this value is obtained as it really occurred during the month under consideration; but it is another matter if we wish to deduce the temperature which this month would have had if the several disturbing causes had not been at work. For this purpose a mean obtained from many years is required. Astronomy, which has been observed for a long time and with very exact instruments, approaches the accurate determination of its elements only slowly, for each later investigation yields somewhat different values, always approaching nearer to the truth. In the atmosphere the disturbances are relatively much greater than in astronomical observations; if there is a succession of several warm winters the mean will be too high, and a series of years may elapse before the error produced thereby will be removed.

This, however, should not deter us from continuing the observations, nor from deducing results from them. Many of the numerical values so obtained will only be determined with sufficient accuracy by our successors. But it is necessary that we should determine the amount of certainty possessed by the numbers found by us. A long series of years does not always give an accurate result. The three winter months, according to my observations for Dorpat, have the following mean temperatures:—2°·90 R., — 5°·96, and — 6°·69. But, although they are based upon 14 years' observations, the numbers are certainly not the same as would be given by continued observations; December is too warm compared with January, and February is too cold. If, therefore, the mean temperature of a single month in our latitudes is so uncertain after 14 years' observations, it is clear that the mean temperature of single days would possess much greater uncertainty if not based upon more than 100 years' observations.

If an arithmetical mean is deduced from individual observations, it is absolutely necessary that we should determine the mean or probable error,

not only of the individual observations, but also of the general mean. I will give in a few words the method proposed by Gauss :—

If $a_1, \quad a_2, \quad a_3 \quad . \quad . \quad . \quad . \quad a_n$

be the numerical values given by n observations, the mean will be

$$x = \frac{a_1 + a_2 + a_3 + . \quad . \quad . \quad . \quad a_n}{n}$$

Even in measurements where the same element is observed with the same instrument, the individual readings differ from each other owing to the imperfection of our senses, and the more so in meteorological phenomena, where so many disturbances occur; the value x is therefore only an approximation to the truth. Let us see, then, how much each of the individual quantities $a_1, \quad a_2 \quad . \quad . \quad . \quad .$ differs from the mean; let these differences be represented by the series

$$\varepsilon_1, \quad \varepsilon_2, \quad \varepsilon_3 \quad . \quad . \quad . \quad . \quad \varepsilon_n$$

If these are added together with their corresponding + or — signs, their sum must $= o$. In order to find the mean error we square all the errors and add their sum. Let this be $\Sigma\varepsilon^2$, then the mean error of a single observation is

$$\sqrt{\frac{\Sigma\varepsilon^2}{n-1}}$$

and the mean error of the final result

$$\sqrt{\frac{\Sigma\varepsilon^2}{n\,(n-1)}}$$

If instead of this we take the probable error, these values become respectively

$$0{\cdot}6745\sqrt{\frac{\Sigma\varepsilon^2}{n-1}} \quad \text{and} \quad 0{\cdot}6745\sqrt{\frac{\Sigma\varepsilon^2}{n\,(n-1)}}$$

If the measurements are continued during a sufficient series of years, the probable error of an individual determination approaches nearer and nearer to a constant; it is *only* when the observations have been carried on for a great number of years that we always obtain the same value, provided the disturbances recur in a similar manner. On the other hand, the probable error of the final result always becomes smaller in proportion as the number of observations increases; it gradually approaches zero, but strictly speaking would only reach this in an infinite series of observations.

An example may explain the above. January 18th is about the coldest day of the year; the changes of temperature during the next few days owing to the alteration in the course of the year are so unimportant that we may neglect them. Twenty-five years' observations (1831-55), by M. Schmidt of Mitau, give the following mean temperatures for this day :—

	Deviation.		Deviation.		Deviation.
°	°	°	°	°	°
— 5·2	— 1·2	— 3·3	+0·7	—10·0	—6·0
— 2·0	+ 2·0	— 0·7	+3·3	—11·0	—7·0
1·5	+ 5·8	1·3	+5·3	1·6	+5·6
2·1	+ 6·1	0·3	+4·3	—10·7	—6·7

	Deviation.		Deviation.		Deviation.
— 1°·0	+ 3°·0	1°·6	+5°·6	— 0°·4	+3°·6
—10·5	— 6·5	— 4·8	—0·8	1·4	+5·4
1·5	+ 5·5	0·2	+4·2	— 6·6	—2·6
—14·7	—10·7	— 11·2	—7·2	— 5·7	—1·7
				—13·1	—9·1

The mean is — 4°·0; if we find the deviations of the separate years from this value, the sum of the negative errors is — 59°·5, that of the positive + 60°·4, their sum is + 0°·9; this would, however, equal zero if another decimal place had been taken. The sum of the squares of these errors is 627·68, ∴ the

mean error of a single determination ... = $\sqrt{\frac{627\cdot68}{24}}$ = ± 5°·11

The probable error „ ... = 0·6745 $\sqrt{\frac{627\cdot68}{24}}$ = ± 3·45

The mean error of the mean ... ... = $\sqrt{\frac{627\cdot68}{25 \times 24}}$ = ± 1·02

The probable error of the mean ... = 0·6745 $\sqrt{\frac{627\cdot68}{25 \times 24}}$ = ± 0·69

Accordingly the mean temperature of the 18th of January lies between the limits — 4°·0 — 1°·02 = — 5°·02, and — 4°·0 + 1°·02 = — 2°·98. If the number of observations is greater, the certainty of the final result increases. The five days from 16th to 20th January have, according to the same register, the mean temperature — 3°·88, which I will take as — 3°·9. If the deviations of these 125 days from the mean are taken and squared, the sum of the latter is 2931·88, therefore the mean error of a single calculation is

$$\sqrt{\frac{2931\cdot88}{124}} = \pm 4°\cdot86$$

and the mean error of the final result

$$\sqrt{\frac{2931\cdot88}{125 \times 124}} = \pm 0\cdot48$$

Therefore the mean error of a single calculation of 125 days is nearly as large as for 25 days, but the error of the final result is reduced from 1°·02 to 0°·48, that is, less than half.

Even *monthly means* leave much uncertainty behind, when not based upon a series of many years' observations. I take as an example the 25 years' means for February at Mitau. These are, for 1831-55 :—

—2°·42	—0°·55	—8°·51	—4°·31	—2°·98
—2·43	—0·78	—0·90	—4·91	—3·33
0·29	—5·99	—0·63	—0·51	—3·82
—0·93	—3·06	—6·11	—1·23	—3·30
0·88	—3·12	—9·09	—2·34	—8·85

The mean is — 3°·10. If we find the error in the same way, the mean for a single calculation will be ± 2°·84, and for the mean ± 0°·57; so that we can only say that the mean temperature of February lies between — 3°·10 — 0°·57 = — 3°·67, and — 3°·10 + 0°·57 = — 2°·53.

Calculations of this kind have the advantage of showing us how far we may rely upon investigations of another kind. Suppose a certain formula to be given, which refers to a greater extension into time or space, and that this represents the temperature of Mitau in February. If the calculated value is not exactly — 3°·10, but lies between the limits — 3°·67 and — 2°·53, we cannot determine wherein the error lies, whether in the incorrectness of the formula, or whether the temperature of February is not yet determined with sufficient accuracy.

If any result is deduced from a series of many years' observations, especially if we have used our own measurements, and if, at the end of each year, we take the mean of all observations hitherto made, we are easily misled into considering the value obtained as much more accurate than it really is. For, generally, the mean always changes less when another fresh year is added. But these small changes in the following years only apparently prove greater certainty. Suppose we had found the value x of a certain phenomenon from observations of n years; and $\varepsilon_1, \varepsilon_2 \ldots \varepsilon_n$ are the deviations of the individual years from the mean, then

$$x = \frac{nx + \varepsilon_1 + \varepsilon_2 + \ldots\ldots\ldots + \varepsilon_n}{n}$$

where the sum of the errors in the numerator equal zero. In the following $(n+1)$ year, let the observed value be $x + \varepsilon_{n+1}$; if we denote the mean of these $(n+1)$ years by x_{n+1}, then

$$x_{n+1} = \frac{(n+1)\,x + \varepsilon_1 + \varepsilon_2 + \ldots\ldots\ldots + \varepsilon_n + \varepsilon_{n+1}}{n+1}$$

$$= x + \frac{\varepsilon_{n+1}}{n+1}$$

or

$$x_{n+1} - x = \frac{\varepsilon_{n+1}}{n+1}$$

The whole change consists in the fact that we divide the difference between the mean of n years and the calculation of the $(n+1)$ year by $n+1$; it therefore becomes smaller the greater the number of years. But if, for example, in deducing the temperature a series of warm years followed, the mean would be apparently more accurate, and it would only be shown when later colder years followed that the earlier values were not accurate.

If I take, for example, in the above series for the temperature of February in Mitau, the mean of 2, 3 . . . . 25 years in the order in which they follow each other, this mean is

From	1	year	° −2·42	From	8	years	° −1·48
,,	2	years	−2·42	,,	9	,,	−1·66
,,	3	,,	−1·52	,,	10	,,	−1·81
,,	4	,,	−1·37	,,	11	,,	−2·42
,,	5	,,	−0·92	,,	12	,,	−2·34
,,	6	,,	−0·86	,,	13	,,	−2·06
,,	7	,,	−0·84	,,	14	,,	−2·64

		°			°
From	15 years	−2·80	From	21 years	−2·78
,,	16 ,,	−2·89	,,	22 ,,	−2·80
,,	17 ,,	−3·02	,,	23 ,,	−2·83
,,	18 ,,	−2·88	,,	24 ,,	−2·86
,,	19 ,,	−2·79	,,	25 ,,	−3·10
,,	20 ,,	−2·77			

In the first seven years, when there were several mild winters, the temperature increases with each succeeding mean; from this time a tolerably regular decrease takes place; if, however, we had come sufficiently near the truth in these observations extending over a period of 25 years, the last means must change less than is the case here.

I have chosen this example, because it rests upon observations made by the same observer, with the same instruments, and at the same hours. If the temperatures of the individual years had followed in the reverse order, or if we had so taken successive means that we began with the last year and proceeded gradually to the first, Mitau would have been apparently warmer, whilst now it is apparently colder. The mean of the first 13 years is −2°·06, that of the following 12 years −4°·23, the difference exceeds 2°. Both periods embrace a series of years such as we do not possess in many calculations—in fact, a great part of the numerical values given in my Meteorology rest upon observations for a shorter period.

If these conditions stimulate us to carry on the observations with greater zeal, in order that later ages may obtain more accurate numbers than we possess at present, they warn us to be cautious in criticising the results of different observers. Suppose the first 13 years, with a mild February, had been separated by a long interval from the 12 following years, an observer would have made the mean temperature of the former period −2°·06 and the latter −4°·23; hence one might easily have doubted one or the other of these results, especially if we did not possess observations from neighbouring regions, to prove whether a similar difference was shown there also.

If, therefore, the monthly means are affected by many irregularities, this is still more the case with other calculations which refer to this month in which only individual observations are used, and the result based upon that for the month. If, for instance, we investigate the temperature, pressure, &c. of the different winds, and take perhaps the frequency of any of the eight winds in a month as alike, then each wind occurs on from 3 to 4 days. If we take for example the SW, with it the barometer is lower than the mean; but the individual readings differ more from each other than perhaps the means of the same month in different years. If an uncertainty arises, therefore, owing to the difference of these numbers from each other, this will be increased by the monthly means, with which we compare them, not yet being accurately determined. For February, for instance, my observations give the following pressure for Dorpat:—

	Lines.
10 years to 1854	332·78
11 ,, 1855	332 93

	Lines.
12 years to 1856	333·03
13 „ 1857	333·41
14 „ 1858	333·78

Supposing the mean height of the barometer with a SW wind was after 10 years as great as after 14 years, the depression according to the last mean would have appeared a whole line greater.

The evil would be still greater if we take the weather into consideration at the same time as the wind. If, for example, we wish to determine the elevation or depression of the barometer with a certain wind on rainy days, or when the weather is mostly clear, the number of the values used would naturally be smaller and the uncertainty greater. I have found in Dorpat only 1, 2 or 3 clear days during a single month with many winds; it requires no proof that the corresponding values are very uncertain, and that a single succeeding observation may double the deviation from the mean. Even such values as it was formerly thought could be determined by a few years' observations, as, for instance, the mean temperature of a place, still leave a degree of uncertainty after a long series of years. Thus 32 years' observations of Wisnewsky, at the Central Physical Observatory of St. Petersburg, give the following temperatures :—

1822...4°·56	1830...2°·92	1838...1°·81	1846...2°·99
1823...3·11	1831...2·78	1839...2·25	1847...3·19
1824...3·35	1832.. 2·62	1840...1·80	1848...3·35
1825...3·28	1833...3·10	1841...3·80	1849...2·34
1826...4·93	1834...2·68	1842...3·34	1850...2·94
1827...3·95	1835...2·81	1843...3·78	1851...3·74
1828...2·45	1836...3·33	1844...2·16	1852...2·35
1829...1·80	1837...2·88	1845...2·32	1853...3·37

The mean is 3°·00, but we find also 4°·93 in the year 1826, and 1°·80 in the years 1829 and 1840, values which differ more than 3° between themselves, and respectively +1°·93 and −1°·20 from the mean. If we square the individual deviations from the mean, the probable error of a single calculation is ± 0°·51 R., and this value will differ little from that which observations of a long series of years would give; the probable error of the final result is ± 0°·0886, so that 32 years' observations leave an uncertainty of 0°·1 remaining.

The quantities given in Meteorological works, therefore, in common with the values in Astronomy and other Natural Sciences, are affected by errors which in general can only be diminished by continued observations. If the thermometer is only observed at a place for a few years, it cannot generally be determined whether the means obtained from these observations for the year are too high or too low; but if there is a place in the neighbourhood where this element has been determined by many years' observations, the values found can be compared with the general mean, and one can decide whether they approach the truth or not, and also estimate the quantities by which the means of the lesser period should be corrected from the long continued observations.

If, then, from what has been said, the general mean of a place is uncertain after a few years,—and if this uncertainty is greater for smaller periods, as in individual months,—the question arises, how the temperature might be distributed in the course of the year or day, if the observations were continued for many years. Two methods are offered: graphical constructions,* and calculation. The former are generally simpler and represent the whole phenomenon clearer to the eye, but always leave a certain amount of uncertainty remaining; the latter is more circumstantial and more difficult, but gives more accurate results.

Calculation of the Observations.

The uncertainty which all numerical values present, whenever they are not determined by a great many observations, exists also in graphical constructions; it is shown at some points of the curves more strongly than at others. If, for instance, we are dealing with the daily temperature curve during a summer month, the thermometer rises quickly from about 7 to 11 o'clock; the errors here are generally little noticed, and the line runs tolerably regularly. From about 1 to 4 o'clock the thermometer changes more slowly; the maximum lies here also, and it is desirable to determine the epoch and its value as accurately as possible. Different persons will here get values varying as regards both the epoch and degree of temperature. The same holds good in the annual march of the temperature. The greatest cold occurs in the higher latitudes at a time when the effect of the sun is least, where winds, cloud, &c. have a great influence. If at this time a NE wind blows for a few days only, with a clear sky, it is more than 10° colder than usual, and the days on which this low temperature is shown will be distinguished for a long series of years by a notably low temperature. If this is repeated in any other year a little earlier or later, the mean will show a second depression of temperature. Wesselowski has given the 5-day means of a number of points for the Russian Empire;—I extract the following values for St. Petersburg from 31 years' observations. By the side of them I quote the values given by Brandes from 9 years' observations:—

		Wesselowski.	Brandes.
Dec.	12—16	−4°·07 R	−6°·14 R
	17—21	−5·30	−7·41
	22—26	−5·24	−6·96
	27—31	−6·58	−7·85
Jan.	1— 5	−6·66	−8·86
	6—10	−6·96	−9·83
	11—15	−7·38	−9·05
	16—20	−7·95	−7·72
	21—25	−7·25	−7·72
	26—30	−7·62	−7·13
Jan. 31.—Feb. 4		−8·05	−7·10

* Article on 'Graphical Constructions' omitted.

		Wesselowski.	Brandes.
		°	°
Feb.	5— 9	—6·75	—6·70
	10—14	—5·93	—7·03
	15—19	—6·42	—7·70
	20—24	—5·94	—7·52
Feb. 25.—	Mar. 1	—5·74	—8·43
March	2— 6	—3·99	—9·71
	7—11	—5·16	—6·90
	12—16	—3·90	—5·61

The temperature falls, therefore, tolerably quickly and regularly to the 16th Jan., and reaches a minimum between the 16th and 20th; it then rises, but reaches a still greater minimum again between 31st Jan. and 4th Feb., and is again followed by fresh depressions between the 15th and 19th Feb. and the 7th and 11th March. If we had observations for St. Petersburg for another 31 years, these depressions would perhaps fall upon totally different days. The values obtained by Brandes from 9 years' observations show in fact remarkable deviations. While in the first series, from 27th Dec. to 9th Jan. the thermometer does not vary 0°·5, we find in the second a fall of 2°; and while from this period in the first series it sinks to a minimum between the 16th and 20th, it rises in the other until the beginning of February, where the first series gives the minimum. That these irregular variations of temperature depend on the winds, I have proved in the case of the serious depression at the end of February and beginning of March ('Meteorology,' II. 56), and I have seen later that Howard also ('Climate of London,' I. 34) takes the same view. The correctness of the latter seems to be proved by the fact, that from 25th February to 26th March the 31 years' period gives a rise of the thermometer of 1°·75, and the second a fall of 1°·28.

If, then, we wish to deduce from the observations here given a result by construction as to the march of the temperature of the year, and so to represent the values as they would probably be given from many years' observations, we should expect that the curve would be drawn with a certain regularity; but it seems to have been decided in this case to reproduce the curve with all its angles and anomalies, and it would seem that St. Petersburg has two minima of temperature, about the middle of January and the beginning of February.

In cases like those quoted, which occur very frequently, calculations afford a far more accurate result. All calculations in Physics are of a double kind. From the causes upon which the individual phenomena are based we deduce the latter not only qualitatively, but also quantitatively, or we apply interpolation formulæ. For meteorological purposes the first can either not be carried out at all, or only with much labour. If we wish, in the above example, to base the calculation upon theoretical considerations, we must not only take into account the declination of the sun, but also the simultaneous distribution of temperature over a great portion of the earth, the amount of pressure in connection with it, direction of wind and its influence upon the

temperature, cloud, rainfall, &c. Therefore we generally use interpolations, because they yield results nearly as accurate and lead sooner to the object in view.

As all interpolation formulæ are only empirical, we can give them a very different form. For many investigations simple parabolic functions are taken. Suppose in the above table we would begin with the first values between 12th and 16th December, then the following intervals could be denoted by 1, 2, 8 .....; if then the temperatures are indicated by y, and the number of the intervals by x, then we could write :—

$$y = a + bx + cx^2 + dx^3 \ldots\ldots\ldots\ldots$$

where a, b, c, d ..... are constants deduced from the observations themselves, and where we take as many terms as we think suitable. As in our case the lowest temperature lies about the middle, it is more convenient to start from the middle; not only in this case are fewer terms of the series necessary, but the calculation is also easier.

I therefore indicate the days between the 26th and 30th January, by 0, then count the intervals backwards and forwards in the order of the natural numbers, in which the preceding intervals are taken as negative, then the temperature is

$$y = a \pm bx + cx^2 \pm dx^3.$$

If I take the 81 years' series, I choose the following four equations for the calculation of the constants :—

$$\begin{aligned}
-4{\cdot}07^{\circ} &= a - 9.b + 81.c + 729.d \\
-7{\cdot}62 &= a \\
-5{\cdot}94 &= a + 5.b + 25.c + 125.d \\
-8{\cdot}90 &= a + 9.b + 81.c + 729.d
\end{aligned}$$

If these equations are solved, then

$$\begin{aligned}
a &= -7{\cdot}62^{\circ} \\
b &= +0{\cdot}15745 \\
c &= +0{\cdot}04486 \\
d &= -0{\cdot}00183
\end{aligned}$$

The following table contains a comparison of the observed temperatures and of the temperatures calculated with these co-efficients (the latter in the column headed " approximate ") :—

No.	Approximate.			Corrected.	
	Observed.	Calculated.	Difference.	Calculated.	Difference.
	°	°	°	°	°
−9	−4·09	−4·09	0	−4·01	−0·08
−8	−5·30	−5·07	−0·23	−4·96	−0·34
−7	−5·24	−5·89	+0·65	−5·35	+0·11
−6	−6·58	−6·55	−0·03	−6·38	−0·20
−5	−6·66	−7·06	+0·40	−6·86	+0·20
−4	−6·96	−7·41	+0·45	−7·20	+0·24
−3	−7·38	−7·64	+0·26	−7·42	+0·04
−2	−7·95	−7·74	−0·21	−7·53	−0·42
−1	−7·25	−7·73	+0·48	−7·53	+0·28
0	−7·62	−7·62	0	−7·43	−0·19
1	−8·05	−7·42	−0·63	−7·25	−0·80
2	−6·75	−7·14	+0·39	−6·99	+0·24
3	−5·93	−6·79	+0·86	−6·67	+0·74
4	−6·42	−6·39	−0·03	−6·30	−0·12
5	−5·94	−5·94	0	−5·88	−0·06
6	−5·74	−5·45	−0·29	−5·42	−0·32
7	−3·99	−4·96	+0·97	−4·54	+0·55
8	−5·16	−4·43	−0·73	−4·45	−0·71
9	−3·90	−3·90	0	−3·95	+0·05

ıe differences between the observed and calculated values are alternately ive and negative, and lie partly within the limit which was given above he uncertainty of such 5-day means. As only a few observations have used here, to determine the constants of the formula, these must be more rately calculated according to the method of least squares. I presume the principles of this method are known, and only make the remark that advantageous in the application of it to put the starting point of the co-ıates in the middle, and then take as many positive as negative values of in the above case, because a great portion of the multiplication will be l, as the sum of the positive and negative quantities equals 0. If the ıcted constants are calculated, the equation gives :—

$$y = -7°{\cdot}4298 + 0{\cdot}14046\,x + 0{\cdot}04254\,x^3 - 0{\cdot}001692\,x^5.$$

ıe temperatures calculated from this formula are entered in the column ed "corrected;" they show a single minimum about the 20th January, here is nothing to remark about the anomalies shown by the observations. ese are to be reproduced by the formula, many more terms must be ; but I think it must be the object of all calculations in Physics to mine exactly a curve by the formula, which fluctuates, as the one drawn would do, in its regular progress. And the differences between the ved and calculated values are smaller than were given above for the ıble errors of such means, so that our successors may determine, after a period, whether the reason of these differences lies in the formula or in act that the observations have not been long enough continued. Be-, the temperature curve deduced by Brandes from the observations of uler shows a march in parts very different, and the mean of both series, regard to the number of years used, would have given a somewhat fluc-ng curve.

There are numerical values often considered in Meteorology, which recur after a certain period, and which, in this period, obtain a more accurate value the oftener they are observed, and the greater the number of observations from which we take the mean,—so it is, for instance, with the mean temperature of the individual months, which after the lapse of a year always have nearly the same value; it is also the same with the temperature of a day, which after 24 hours should have the same value, if there were not disturbances caused by winds, &c. although here long continued observations would show that in the first half of the year the temperature of any hour in the following day is somewhat higher than in the previous day, while in the second half of the year the opposite takes place. If therefore at one place hourly observations have been made for several years, and if for each month the mean of the temperature observed at the same hour is taken, it is not strictly correct, if we consider these means obtained to be such as belong exactly to this day, but we have in the numbers found, on the one hand, quantities belonging to the daily period, and on the other hand, the variation which corresponds to the march of temperature from the end of the previous to the beginning of the following day. If we draw the yearly temperature curve from many years' observations, the portion which corresponds to April is nearly a straight line, therefore the temperature rises from one day to the following by about the same quantity. If, then, according to these observations, the 1st May was 6° warmer than the 31st March, the mean of each day would be about 0°·2 warmer than the previous day; if we distribute this over the hours, each would take $\frac{0°.2}{24} = 0°.0083$; if the hours are reckoned from 1 to 24, indifferently as to which hour 1 corresponds, the 24th is, owing to this circumstance, 0°·19 warmer than that indicated by 1, and in a strict calculation of the period, regard must be paid to this change in each individual calculation.* This correction, which in a rigid theoretical investigation of the subject would be necessary, is in the ordinary calculation of the observations less necessary, for independently of the fact that it is only small in the majority of the months the quantities which we deduce from the calculation of the mean serve chiefly to check the mean temperatures of such places where only a few observations are taken during the day, where indeed errors occur in the same way.

For quantities like the above mentioned, parabolic functions would be unsuitable, and the use of periodic functions is here, at all events, more appropriate. It appears that Lambert was the first that used them, in his investigations on the warming of the earth by the sun.† In the same way the ordinary reckoning of time is divided into 24 equal parts, we suppose also the circumference of the circle subdivided, then each hour corresponds to an angle of 15°; and if we indicate a point on the circle by 0 and regard this as the beginning of the reckoning of time, then the nth hour corresponds

* See Rikatcheff's paper :—"Marche diurne de la Température à St. Petersbourg 1873. (Translator.)

† Lambert, Pyrométrie, 4. Berlin 1779, p. 334.

to the angle $n.15°$. Lambert assumed that the observed quantity a, which corresponds to this hour, can be expressed by an equation of the form:—

$$a = p + p_1 \cos u + q_1 \sin u + p_2 \cos 2u + q_2 \sin 2u + p_3 \cos 3u + q_3 \sin 3u \ldots$$

and he applied this to a series of temperature observations. Here u is the angle, which corresponds to the epoch of time (n . 15°) in which the observation was made; a is the observed value, and p, p_1, p_2 .....q_1, q_2, q_3,..... are constants deduced from the observed values. A long time elapsed without an attempt being made to utilise this very convenient expression, which enables us to view the course of a phenomenon more precisely than by the observations themselves; Bessel first made use of it in 1814 (Jenaische Literatur-zeitung, 1814, No. 231) to determine the laws of the daily fluctuations of the barometer, and he afterwards wrote a detailed account of its application (Schumacher, Astron. Nachr. Bd. VI. No. 136).* Then it was used especially by Hällström (Poggend. Annal. IV. 405; VIII. 131; XI. 351), by Bouvard (Mém. de l'Acad. des Sciences, VII. 300; Biblioth. Univ. XLI. 276), by Schmidt (Math. u. Phys. Geograph. II. 279), by myself and others, and we have been more and more convinced of its suitability.

With respect to the theoretical proof of this applicability, I will not touch upon the old controversy raised in the investigation of vibrating strings, as to whether an expression of this kind was suitable to express also each non-continuous function. We have partially to do with the latter in meteorology, for if, for example, we investigate the daily march of the temperature, different causes act, according as the sun is above or below the horizon; calculation shows here the possibility of applying the expression. Fourier also proved (Théorie de la Chaleur, p. 167) that the value of any function could be given thereby, and subsequently analists, amongst whom are †Poisson, †Lejeune-Dirichlet, †Schlömilch, have not only more precisely established this theory, but have shown that the series constantly converges. But, however useful this expression may be in the consideration of meteorological phenomena, and however frequently it has been made use of by myself and others, we should never forget that it is only an interpolation formula, which we employ because hitherto it is not possible for us to develop, the values which are represented by it by theoretical considerations. Lagrange, who calls the curve represented by this equation the generatrix (courbe génératrice), very truly remarks with reference to its application in vibrating strings:—‡

"Il est certain, que si on veut, que la courbe génératrice soit la même géométriquement que la courbe initiale, il faut que celle-ci soit renfermée dans l'équation

$$y = a_1 \sin x + a_2 \sin 2x + \ldots .$$

Je dis la *même géométriquement*, car il suffit que la différence de ces deux

* See Translation in 'Quarterly Weather Report' of the Meteorological Office, 1870. Part IV., Appendix. (Translator.)

† References to the Papers are given in the original work.

‡ Miscell. Taurin. III. 259.

courbes soit moindre qu'aucune grandeur donnée, pour qu'elles puissent être prises pour les mêmes. Or il est clair que quelle que soit la courbe initiale, on peut faire passer, par une infinité de points infiniment proches de cette courbe, une autre courbe de la forme

$$y = a_1 \sin x + a_2 \sin 2x + \ldots$$

de manière que la différence entre les deux courbes soit aussi petite qu'on voudra, quoique cette différence ne puisse devenir absolument nulle, que dans le cas où la courbe initiale sera aussi de la même forme. Dans tous les autres cas cette courbe initiale ne sera qu'une espèce d'asymptote dont la courbe génératrice pourra s'approcher à l'infini, sans qu'elles puissent jamais coincider entièrement."

The easiest application of this formula is when we have a series of observations made at equal intervals in the course of the period. This is the case whenever an instrument is observed from hour to hour, so that we get 24 equally distant calculations during the day. We begin the numbering of the hours at any moment, usually at noon,* and number them to 24; let S_1, S_2,.....S_{24} be the observed values corresponding to the individual hours; an hour corresponds to an arc of 15° in the circumference of a circle, and we get the following 24 equations:—

$$S_1 = p + p_1 \qquad + p_2 \qquad + p_3$$

$$S_2 = p + p_1 \cos 15° + q_1 \sin 15° + p_2 \cos 30° + q_2 \sin 30° + p_3 \cos 45° + q_3 \sin 45° \ldots$$

$$S_3 = p + p_1 \cos 30° + q_1 \sin 30° + p_2 \cos 60° + q_2 \sin 60° + p_3 \cos 90° + q_3 \sin 90° \ldots$$

.....

$$S_{24} = p + p_1 \cos 345° + q_1 \sin 345° + p_2 \cos 330° + q_2 \sin 330° + p_3 \cos 315° + q_3 \sin 315° \ldots$$

How far we continue the series depends on how far we wish to carry the approximation. If, for instance, it is a question of deducing a series for the daily range of temperature, and if the observations embrace only a few years, it is quite sufficient to continue the calculation to the 3rd hour angle, as the quantities made use of are not yet sufficiently accurate to repay the trouble of further calculation. If, however, the latter are determined by a long series of years, the terms referring to the 4th hour angle may be added. I shall make some remarks on this point afterwards.

If we wish to determine the constants p, p_1, p_2 ..... q_1, q_2 ..... the method of least squares leads much quicker to the end than if we only made use of so many equations as there are unknown quantities. If we first multiply each equation with the co-efficient of p, (therefore 1) and add, we get on the left side:—

$$S_1 + S_2 + \ldots\ldots + S_{24},$$

* In accordance with the Resolutions of the Vienna Congress (1874), the day is usually reckoned from midnight to midnight. (Translator.)

therefore the sum of the observed values on the right side is first found to be $24\,p$; with regard to the remaining terms on this side, the first is

$$p_1\,(1 + \cos 15° + \cos 30° + \ldots\ \ldots\ \ldots + \cos 345°).$$

The second is

$$q_1\,(\sin 15° + \sin 30° + \ldots\ \ldots\ \ldots\ \ldots\ \ldots + \sin 345°).$$

If, however, we divide the circumference of the circle into n equal parts, then by a known principle of Trigonometry

$$1 + \cos\frac{2\pi}{n} + \cos 2\,.\,\frac{2\pi}{n} + \ldots\ \ldots\ \ldots + \cos(n-1).\,\frac{2\pi}{n} = 0$$

$$\sin\frac{2\pi}{n} + \sin 2\,.\,\frac{2\pi}{n} + \ldots\ \ldots\ \ldots + \sin(n-1).\,\frac{2\pi}{n} = 0;$$

accordingly the whole sums on the right-hand side vanish, and the final equation is

$$S_1 + S_2 + \ldots\ \ldots\ \ldots\ \ldots\ \ldots + S_{24} = 24\,p,$$

or if we express the sum of the observed values by $[a]$ and generally have n determinations of the period :—

$$[a] = np \text{ or } p = \frac{1}{n}[a],$$

and is, therefore, the same as the arithmetical mean.

In order to obtain an equation for p_1, each of the above equations is multiplied by the coefficient of p_1; we get thereby on the left-hand side the sums :—

$$S_1 + S_2 \cos 15° + S_3 \cos 30° + \ldots\ \ldots\ \ldots + S_{24} \cos 345°,$$

on the right-hand side the co-efficient of $p = 0$, that of p_1 is

$$1 + \cos^2 15° + \cos^2 30° + \cos^2 45° \ldots\ \ldots\ \ldots\ \ldots\ \ldots + \cos^2 345°.$$

If, however, in general θ is the nth part of the circumference of the circle, then

$$1 + \cos^2\theta + \cos^2 2\,\theta + \ldots\ \ldots\ \ldots\ \ldots\ \ldots + \cos^2(n-1)\,\theta = \tfrac{1}{2}\,n,$$

and in the same manner

$$\sin\theta^2 + \sin^2 2\,\theta + \ldots\ \ldots\ \ldots\ \ldots\ \ldots\ \ldots + \sin^2(n-1)\,\theta = \frac{1}{n}\,n.$$

Therefore in our expression of the sums the term containing p_1 is $\frac{1}{2}n$, that is, 12.

The following term is

q_1 (sin 15° cos 15° + sin 30° cos 30° ... ... + sin 345° cos 345°)

The series included in the brackets is equal to 0, and the same holds good of the following terms, we therefore obtain the final result:—

$$(S_1 + S_2 \cos 15° + S_3 \cos 30° \ldots\ \ldots\ \ldots + S_{24} \cos 345°) = 12\,p_1,$$

and

$$(S_2 \sin 15° + S_3 \sin 30° \ldots\ \ldots\ \ldots\ \ldots\ \ldots + S_{24} \sin 345°) = 12\,q_1.$$

Similar considerations hold good for the following terms, and if we have regard to the equality of the sines and cosines and to the signs in the equations so found, we get the following series of equations, in which I have so written the quantities as they are best arranged when applied to numerical examples :—*

* Mr. Rundell has printed Tables for facilitating these calculations, by the use of natural sines, &c. (Translator.)

$$p = \frac{S_1 + S_2 + S_3 + \ldots\ \ldots\ \ldots + S_{24}}{24}.$$

$$12\,p_1 = \begin{pmatrix} S_2 - S_{12} \\ +S_{24} - S_{14} \end{pmatrix} \cos 15° + \begin{pmatrix} S_3 - S_{11} \\ +S_{22} - S_{15} \end{pmatrix} \cos 30° + \begin{pmatrix} S_4 - S_{10} \\ +S_{22} - S_{16} \end{pmatrix} \cos 45° +$$
$$\begin{pmatrix} S_5 - S_9 \\ +S_{21} - S_{17} \end{pmatrix} \cos 60° + \begin{pmatrix} S_6 - S_8 \\ +S_{20} - S_{18} \end{pmatrix} \cos 75° + S_1 - S_{13}$$

$$12\,q_1 = \begin{pmatrix} S_2 - S_{14} \\ +S_{12} - S_{24} \end{pmatrix} \sin 15° + \begin{pmatrix} S_3 - S_{15} \\ +S_{11} - S_{23} \end{pmatrix} \sin 30° + \begin{pmatrix} S_4 - S_{16} \\ +S_{10} - S_{22} \end{pmatrix} \sin 45° +$$
$$\begin{pmatrix} S_5 - S_{17} \\ +S_9 - S_{21} \end{pmatrix} \sin 60° + \begin{pmatrix} S_6 - S_{18} \\ +S_8 - S_{20} \end{pmatrix} \sin 75° + S_7 - S_{19}$$

$$12\,p_2 = \begin{Bmatrix} S_2 - S_6 \\ +S_{12} - S_8 \\ +S_{14} - S_{18} \\ +S_{24} - S_{20} \end{Bmatrix} \cos 30° + \begin{Bmatrix} S_2 - S_5 \\ +S_{11} - S_9 \\ +S_{15} - S_{17} \\ +S_{23} - S \end{Bmatrix} \cos 60° \quad \begin{matrix} +S_1 - S_7 \\ +S_{13} - S_{19} \end{matrix}$$

$$12\,q_2 = \begin{Bmatrix} S_2 - S_8 \\ +S_6 - S_{12} \\ +S_{14} - S_{20} \\ +S_{18} - S_{24} \end{Bmatrix} \sin 30° + \begin{Bmatrix} S_2 - S_9 \\ +S_5 - S_{11} \\ +S_{15} - S_{21} \\ +S_{17} - S_{23} \end{Bmatrix} \sin 60° \quad \begin{matrix} +S_4 - S_{10} \\ +S_{16} - S_{22} \end{matrix}$$

$$12\,p_3 = \begin{Bmatrix} S_2 - S_4 \\ +S_8 - S_6 \\ +S_{10} - S_{12} \\ +S_{16} - S_{14} \\ +S_{18} - S_{20} \\ +S_{24} - S_{22} \end{Bmatrix} \cos 45° \quad \begin{matrix} +S_1 - S_5 \\ +S_9 - S_{13} \\ +S_{17} - S_{21} \end{matrix}$$

$$12\,q_3 = \begin{Bmatrix} S_2 - S_6 \\ +S_4 - S_8 \\ +S_{10} - S_{14} \\ +S_{12} - S_{16} \\ +S_{18} - S_{22} \\ +S_{20} - S_{24} \end{Bmatrix} \sin 45° \quad \begin{matrix} +S_1 - \\ +S_{11} - \\ +S_{21} - \end{matrix}$$

$$12\,p_4 = \begin{Bmatrix} S_2 - S_3 \\ +S_6 - S_5 \\ +S_8 - S_9 \\ +S_{12} - S_{11} \\ +S_{14} - S_{15} \\ +S_{18} - S_{17} \\ +S_{20} - S_{21} \\ +S_{24} - S_{23} \end{Bmatrix} \cos 60° \quad \begin{matrix} +S_1 - S_4 \\ +S_7 - S_{10} \\ +S_{13} - S_{16} \\ +S_{19} - S_{22} \end{matrix}$$

$$12\,q_4 = \begin{Bmatrix} S_2 - S_5 \\ +S_3 - S_6 \\ +S_8 - S_{11} \\ +S_9 - S_{12} \\ +S_{14} - S_{17} \\ +S_{15} - S_{18} \\ +S_{20} - S_{23} \\ +S_{21} - S_{24} \end{Bmatrix} \sin 60°$$

If the observations are made every two hours, and therefore only 12 values given in the period, *e.g.* in the mean temperature of the individual months, then all the terms in which the uneven numbers occur disappear, and the numerical coefficients of p and q become 6.

The great advantage in this method is, that all numerical coefficients are calculated independently of each other; not only does this admit of an easy deduction of the same, but if, for instance, we have gone as far as the 2nd angle and found that the differences between observed and calculated values were still somewhat large, we could deduce the 3rd angle without altering the coefficients of the 1st and 2nd angles, so that we need pay no further attention to these. We can also determine whether it is necessary to add new terms to the series without comparing the calculated and observed values. If, for example, we square the observed values and denote their sum by $[a\ a]$ then, according to the principles of the method of least squares, the sum of the squares of the remaining errors is determined by the equation

$$[a\ a] - n\,p\,p - \frac{n}{2}p_1 p_1 - \frac{n}{2}q_1 q_1 - \frac{n}{2}p_2 p_2 - \frac{n}{2}q_2\,q_2 \ldots\ \ldots\ \ldots;$$

but I expressly observe that I prefer to make the comparison itself, for we learn from the quality of the errors themselves whether these still show a periodicity, and therefore whether fresh terms are still necessary.

The accuracy of the calculation is most easily checked in the following way. The arithmetical mean p of the 24 observations is most safely proved by doing the work twice over. As regards the other terms, we have in p and the corresponding q the same quantities, which are multiplied by the sine or cosine of the same angle, and only distinguished by the sign. If, therefore, the calculation gives, say, $(a-b)$ sin 45° and $(c-d)$ sin 45°, then $a+b$ must equal $c+d$. If this is not the case, there must be a mistake in the work.

The method here given has often been applied in my Treatise on Meteorology and by others; but many problems allow of a still more precise calculation. If, for instance, we have hourly observations of temperature in each month, we may perform the calculation in two ways. We can, as usual, investigate the march of the temperature in the same month; or we can also determine the state of the thermometer at the same hour during the year. In a comprehensive investigation both periods must be taken into consideration at the same time. In this case the following method is applied. After the various values of p and q for each month are found, the yearly period of each of them is investigated in the same manner as before; these calculated values I take as the more probable, and with them calculate in each month the temperatures of the individual hours, in which I usually retain only the arithmetical mean (p) as given by each month. In this case the differences between observed and calculated values are certainly greater than if the constants are retained as given by each month, but I think that the conditions corresponding to the climate of the place are more accurately expressed thereby. Suppose during a hot day in July the temperature in the afternoon was lowered suddenly 10° or more by a thunderstorm, and even that this were repeated during several successive days, as frequently happens, the influence of this would be exhibited in the monthly mean, and the constants of the function would thereby be somewhat different than would be the case if this disturbance had not occurred; they would as nearly as possible agree with the anomaly. In June and August perhaps the temperature changes more regularly; and this regularity, which is shown more or less in other years, gives the constants of each month more certainty. Moreover this calculation confirms the remark made above, that the labour is hardly repaid, if the later terms are taken into account, when the observations embrace only a few years. For example, p_1 and q_1 are determined with tolerable certainty in the march of daily temperature even by observations of a single year. If we seek the annual march for p_2 and q_2, the differences between the calculated and observed values are greater; it happens, not unfrequently, that with p_4 and q_4 if the calculation for a single month had given them positive values, the yearly period gives equally as large negative values, and conversely; a proof that their determination is so uncertain that the labour of calculation is not repaid. Only a long series of years gives a greater certainty to these values, as I have convinced myself when I only made use of a few years for individual places, and in a

later repetition of the calculation could base them upon a longer series of years.

If the quantities p and q are determined, the equation allows of a somewhat different expression.

If

$$p_1 = u_1 \sin V_1 \quad , \quad q_1 = u_1 \cos V_1$$

the general term becomes:—

$p_1 \cos n \cdot 15° + q_1 \sin n \cdot 15° =$

$$u_1 \sin V_1 \cos n \cdot 15° + u_1 \cos V_1 \sin n \cdot 15° = u_1 \sin (V_1 + n \cdot 15°)$$

where $\tan V_1 = \frac{p_1}{q_1}$ and $u_1 = \frac{p_1}{\sin V_1} = \frac{q_1}{\cos V_1}$

If this substitution is made in the remaining terms, the general equation becomes:—

$$a_n = p + u_1 \sin (V_1 + n \cdot 15°) + u_2 \sin (V_2 + n \cdot 30°) + u_3 \sin (V_3 + n \cdot 45°) + \ldots$$

Simple as is the deduction of the constants in this series, the calculation is, however, very tedious if we often apply the equation, even when, as usual, five place logarithms are used. As sin 15°, sin 45°, sin 60°, and sin 75° are always used, I have added a table containing the multiples of these quantities, whereby the multiplications are saved; I have calculated them for the whole numbers, and any one can determine the proper decimal places in any problem.* If the quantity, which is multiplied by one of these sines, should contain one decimal place more than is given in the table, the interpolation is easily effected; suppose in the investigation of the range of temperature we had to calculate 11·62 sin 75°, the table gives:—

$$11{\cdot}6 \sin 75° = 11{\cdot}2048$$
$$11{\cdot}7 \quad ,, \quad = 11{\cdot}3014$$

Diff. for 0·1 = 0·0966, or for 0·01, 0·00966, consequently 11.62 sin 75° = 11·2048 + 0·0193 = 11·2141.

If, however, in calculations of the range of temperature we are content with two decimal places, cases of this kind seldom occur, according to my experience, and then we can easily make the interpolations; moreover, in the use of more decimals the last is so uncertain, that we may just as well omit the last place in the sum obtained, as is done in similar calculations.

If the constants of the equation are determined, and if we wish to calculate from them the values corresponding to individual points of the period, one of the following two equations can be used:—

$$a = p + p_1 \cos n \cdot 15° + q_1 \sin n \cdot 15° + \ldots$$

or

$$a = p + u_1 \sin (V_1 + n \cdot 15) + \ldots$$

The individual products which occur in the first of them can be taken out of the table of multiples of sin 15°, &c. or if we wish for greater accuracy—as p and q as a rule contain more significant figures than the table gives—we have only a few logarithms to look out. If we apply the second formula, we

* Tables not printed. See note at the foot of page 133, with reference to Mr. Rundell's Tables. (Translator.)

must determine the value of $V_1 + n \cdot 15°$ for each hour, and look out the appropriate log. sines and log. cosines. I always prefer the latter method, for if fewer multiplications occur in the first, we must make six additions or subtractions if we go as far as the third angle. In the second method the number of operations is half as great, moreover the number of multiplications is less than appears at the first glance. For, for the hours 1 and 13, 7 and 19, the products $u_1 \sin (n \cdot 15° + V_1)$ are given by the values of p_1 and q_1. If we take for this single angle the hours 2 and 14, the products $u_1 \sin (15° + V_1)$ and $u_1 \sin (195° + V_1)$ belong to them; these are equal, but opposite. The products $u_1 \sin (105° + V_1)$ and $\sin (285° + V_1)$ belong to the hours 8 and 20, these are $u_1 \cos (15° + V_1)$ and $u_1 \cos (195° + V_1)$; if, therefore, we take from the tables at the same time the value of the sine and cosine, we have these four values at one time, and so for the single angle we only look out the logs. of sin. and cos. for the hours 2, 3, 4, 5, and 6. For the double angle we need only turn up these numbers for the hours 2 and 3, for the third angle only the hour 3, and so on. Moreover, it is advantageous to calculate at once the values for the hours 1 and 13, 2 and 14 . . . . then the same quantities are added and subtracted at the same time, or added in one and subtracted in the other.

After having convinced oneself that the constants are sufficiently accurate, it is often of interest in many problems to calculate the epochs of maxima and minima and their exact values. If for this purpose we differentiate the equation

$$a = p + u_1 \sin (n \cdot 15° + V_1) + u_2 \sin (n \cdot 30° + V_2) \ . \ . \ .$$

and solve this, we get the roots very accurately.* But the equation to be solved is of a higher degree when the sin. is changed into cos., or *vice versâ*, and the solution which is always but an approximation requires much time. The object is attained much sooner by "probing." For instance, if we take the highest temperature, say between 2 and 3 o'clock, we see immediately from the values found for these two hours whether it is nearest 2 or 3 o'clock, and so guess where it occurs. If we suppose it to be at $2\frac{1}{4}$ *h*, to which time the angle $(34° + V_1)$ corresponds, we then calculate the temperature for the times corresponding to the three angles $33° + V_1$, $34° + V_1$ and $35° + V_1$, which can be done very rapidly. Then if the greatest value belongs to $34° + V_1$, and $33° + V_1$ and $35° + V_1$ both equal, the maximum is determined with sufficient accuracy. If a somewhat greater value belongs to $35° + V_1$ than to $33° + V_1$ we can here either estimate, or calculate other angles between $34° + V_1$ and $35° + V_1$ in the same way. But this does not seem necessary, as four minutes correspond to an angle of 1°, and it is only in very rare cases that we can be sure of this value.

In the same way the time for the mean is determined; as p = the arithmetical mean of the observed values, we have to solve the equation

$$0 = u_1 \sin (n \cdot 15° + V_1) + u_2 \sin (n \cdot 30° + V_2) + \ . \ . \ . \ .$$

* See Formula given by Dr. Jelinek, in his great work, On the Discussion of Observations made at Prague, 1850 (p. 18), which leads to the same result more easily. (Translator.)

which is also most conveniently done by "probing," as the moment of mean temperature is nearly known.

In this way it can also be judged whether the mean of the observations at the different times is equal to the true mean or not. Supposing we have observed at times corresponding to the hour angles $m \cdot 15°$, $n \cdot 15°$, $q \cdot 15°$, we then get the following equations:—

$$a_m = p + u_1 \sin (m.15° + V_1) + u_2 \sin (m.30° + V_2) + \ldots$$
$$a_n = p + u_1 \sin (n.15° + V_1) + u_2 \sin (n.30° + V_2) + \ldots$$
$$a_q = p + u_1 \sin (q.15° + V_1) + (u_2 \sin (q.30° + V_2) + \ldots$$
$$\ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots$$

If we have in this way r observations made during the day, and should their arithmetical mean be equal to the true mean, then must

$$\frac{a_m + a_n + a_q \ldots \ldots}{r} = p.$$

This, however, pre-supposes that the sum of the remaining terms on the right-hand side vanishes, and this leads especially to the conditional equations

$$u_1 \sin (m.15° + V_1) + u_1 \sin (n.15° + V_1) + \ldots = 0$$
$$u_2 \sin (m.30° + V_2) + u_2 \sin (n.30° + V_2) + \ldots = 0,$$

as these are of the greatest importance, although it is also possible that the sum of the two or more conditional equations vanishes, while each still retains a determinate value.

Most observers will make their observations at the exact hours, therefore I will add a few remarks for these. If two observations are made daily, at equidistant intervals, we get the following two equations:—

$$a_n - p = u_1 \sin (n.15° + V_1) + u_2 \sin (n.30° + V_2) + \ldots$$
$$a_m - p = u_1 \sin (n.15° + 180° + V_1) + u_2 \sin (n.30° + 360° + V_2) + u_3 \sin (n\ 45° + 180° + V_3) + \ldots$$

Here the sum of the terms on the right-hand side must $= 0$

Now

$$u_1 \sin (n.15° + V_1) = - u_1 \sin (n.15° + 180° + V_1)$$

and the sum of both is 0.

Further

$$u_2 \sin (n.30° + V_2) = u_2 \sin (n.30° + 360° + V_2).$$

Therefore their sum is

$$2\ u_2 \sin (n.30° + V_2).$$

The sum of the two terms, which contain the three-fold angle, is again 0; on the other hand, we obtain for the fourth angle:

$$2\ u_4 \sin (n.60° + V_4).$$

We obtain, therefore, as the difference between the mean of the observed values and the true mean (on account of the division by 2):—

$$u_2 \sin (n.30° + V_2) + u_4 \sin (n.60° + V_4),$$

or, if we omit the fourth angle:—

$$u_2 \sin (n.30° + V_2).$$

Should therefore the mean of the two observations be equal to the true mean, the angle sin $(n.30° + V_2)$ must be so chosen that the sin $= 0$, and if this should not fall at any whole hour, we take the nearest.

If three equidistant observations are taken, the equations are :—

$$a - p = u_1 \sin (n.15° + V_1) + u_2 \sin (n.30° + V_2) + \ldots .$$
$$a_1 - p = u_1 \sin (n.15° + 120° + V_1) + u_2 \sin (n.30° + 240° + V_2) + u_3 \sin (n.45° + V_3) + u_4 \sin (n.60° + 120° + V_4) + \ldots$$
$$a_2 - p = u_1 \sin (n.15° + 240° + V_1) + u_2 \sin (n.30° + 120° + V_2) + u_3 \sin (n.45° + V_3) + u_4 \sin (n.60° + 240° + V_4) + \ldots$$

On the right-hand side we have

$$u_1 \sin (n.15° + V_1) + u_1 \sin (n.15° + 120° + V_1) + u_1 \sin (n.15° + 240° + V_1) = 0.$$

The same holds of the terms which contain u_2 and u_4, and there remains, therefore, only the mean $u_3 \sin (n.45° + V_3)$, therefore $\sin (n.45° + V_3)$ gives the hour. Since, however, u_3 is usually smaller than u_2, so $u_3 \sin (n.45° + V_3)$ is generally smaller than $u_2 \sin (n.30° + V_2)$, and we see that without a better choice of hours, three equidistant observations give generally a more accurate result than two.

If we take four equidistant observations, we obtain in the same manner the following conditional equations :—

$$\left.\begin{array}{l} u_1 \sin (n.15° + V_1) + u_1 \sin (n.15° + 90° + V_1) + \\ u_1 \sin (n.15° + 180° + V_1) + u_1 \sin (n.15° + 270° + V_1) \end{array}\right\} = 0,$$

$$\left.\begin{array}{l} u_2 \sin (n.30° + V_2) + u_2 \sin (n.30° + 180° + V_2) + \\ u_2 \sin (n.30° + V_2) + u_2 \sin (n.30° + 180° + V_2) \end{array}\right\} = 0,$$

$$\left.\begin{array}{l} u_3 \sin (n.45° + V_3) + u_3 \sin (n.45° + 270° + V_3) + \\ u_3 \sin (n.45° + 180° + V_3) + u_3 \sin (n.45° + 90° + V_3) \end{array}\right\} = 0,$$

$$\left.\begin{array}{l} u_4 \sin (n\ 60° + V_4) + u_4 \sin (n.60° + V_4) + \\ u_4 \sin (n.60° + V_4) + u_4 \sin (n.60° + V_4) \end{array}\right\} = 4 \sin (n.60° + V_4);$$

hence the mean $u_4 \sin (n.60° + V_4)$.

As now u_4 has a small value this product is never important, and we see, therefore, that four equidistant observations give the mean temperature very nearly, however the hours may be chosen. If we take 6, 8 or 12 equidistant observations, their mean always agrees with that of all 24 observations. In the deduction of the constants, it is presumed above that none of the equidistant observations are missing during the whole period, and then the calculation is simple and easy. If many of them are missing, if *e. g.* we have hourly observations of the temperature during the day but not during the night, the calculation is more difficult ; for if we make the necessary multiplications to deduce the final equations, the products no longer cancel each other, and each of these equations contains in general the whole of the constants p, q, . . . , and therefore the elimination is more intricate.

In this case graphical constructions afford the advantage of giving figures which may be utilised in determining the constants of the periodical expression. If, then, a comparison shows that the quantities given by the formula differ much from those which are deduced by construction, the calculation can be repeated with the former. If we use the observations at a place where the observations are also given during the night, but some of them are omitted,

and with the help of the rest a curve is drawn in which the quantities for the missing hours are obtained, we are persuaded that we approach tolerably nearly to the truth. As the lowest temperature everywhere occurs somewhat before the rising of the sun, the position is given thereby where the curve bends; the magnitude of the minimum is, however, very correctly obtained when the course of the curve in the remaining portion of the day was well drawn. At the observatories of the Russian Empire, observations were only made in the day-time during the first years. The constants which I deduced from them, and the other conditions of the curve agree closely with that which the later hourly observations give.

There are still other phenomena in the domain of meteorology and kindred sciences which may be represented by the use of periodical functions, to which they have not yet been applied. The secular variations of the Declination of the magnetic needle, for instance, are usually represented by parabolic equations; it appears to me, however, more suitable to use periodic functions in this case also. The evil certainly is, that the duration of the period is not given so directly as in the daily and yearly variations. In Paris we know more than half the period. While I assumed a value for the length of the latter, and sought the value of the angle x in time, I calculated by the help of a few observations the constants a, b, c, in the expression

$$a + b \sin x + c \cos x + d \sin 2x + \ldots .$$

By the errors which now remain, not only the constants but also x are more accurately determined. The calculated values agreed now with the observations, at least quite as well as with parabolic functions. I used the value of x thus found for Paris as a first approximation for other places; it was shown that the value was different at each place, but this change followed pretty regularly the change of latitude and longitude.*

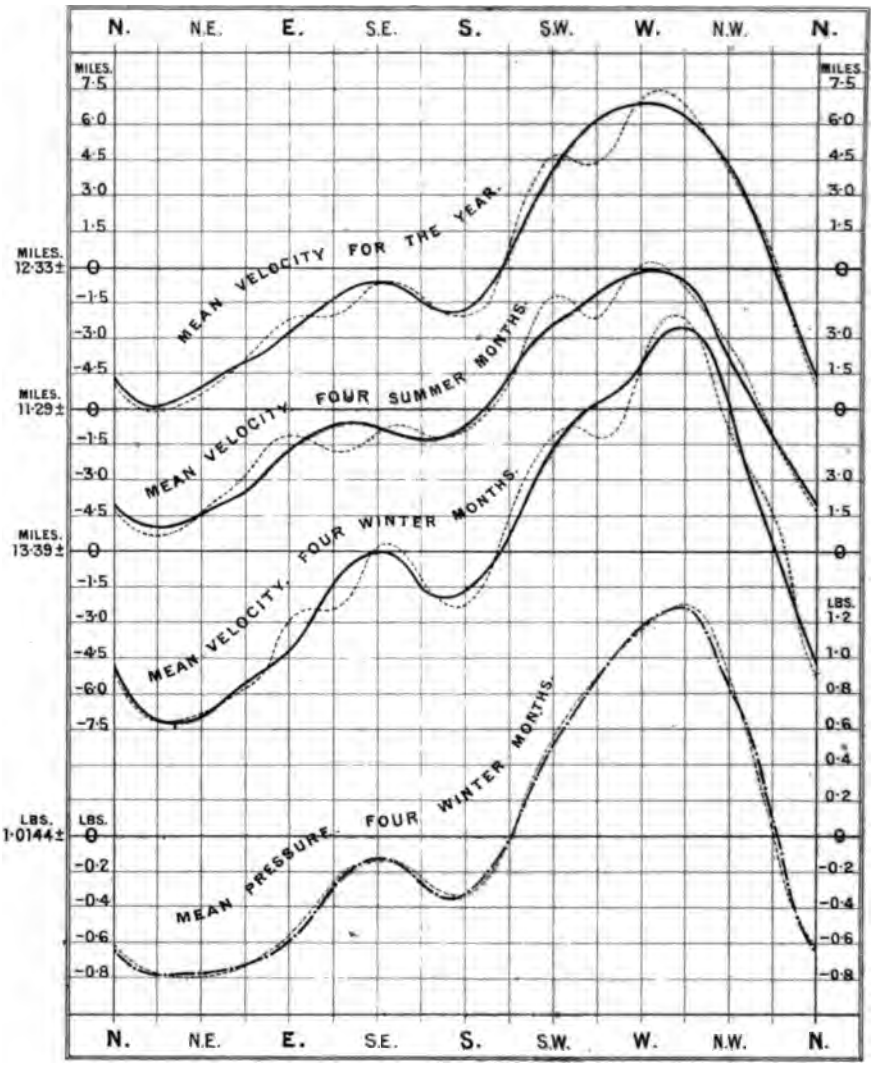
DISCUSSION.

The PRESIDENT observed that the method of reduction of meteorological observations advocated by Kämtz was but little used in this country; the only person by whom it was systematically adopted, so far as he was aware, being the Rev. R. Main, the Radcliffe Observer at Oxford. This was probably due to the fact that the graphical method of determining the course of curves of temperature and other meteorological elements occupied less time and labour.

Mr. C. HARDING said that it was not necessary to have 20 or 30 years' observations before Bessel's formula could be used. If we refer to Mr. Rundell's paper, communicated to the Society (see Quarterly Journal, vol. II. p. 217), we shall see that he deals with very short periods. The Radcliffe Observatory also most persistently uses the formula for obtaining the constants of various elements for each month and year. The application of the formula is simple, but observers should be cautioned against using too many figures in their calculations, or of gilding the results deduced with a fictitious accuracy, since Bessel's expression is merely an equation to the curve passing through the means at the respective epochs of observation. In calculating the expression for the year, from the 12 monthly means, it is very important that the monthly means be as nearly equidistant as possible; to this end it seems desirable to include with February the last day of January and the first day of March. For the calculation of maxima

* Tables for facilitating the calculations are given in the original, but not printed here. (Translator.)

WINDS AT LIVERPOOL.



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and minima, Dr. Jelinek's formula, referred to in the translation, cannot be too strongly recommended. He had found, from a somewhat exceptional opportunity of testing its worth, that the results deduced are highly satisfactory; the *approximate time* is amply sufficient in meteorological discussions, and this formula has the additional advantage of being directly applicable to original observations.

XIII. *Velocity of the Wind at Liverpool: Tabulation of Anemometric Records.*

By W. W. Rundell, F.M.S.

[Received January 28th.—Read April 19th, 1876.]

How should anemometric records be tabulated? Ought the mean velocity recorded for each hour to be converted into figures representing force? Should the usual, or any other, constant which may be used for this purpose be corrected for barometric pressure? Ought not a separation to be made between cyclonic and anticyclonic periods, and ought not the corresponding temperatures for the wind for the several points of the compass to be recorded? Are not sixteen points of the compass ample for this purpose? If not, will not intervals of 15° of azimuth be preferable to points? This mode would retain the eight principal points N, NE, E, SE, &c., but divide the intervals between them into three instead of into four parts.

These and similar questions have presented themselves during a recent examination of wind velocities at Liverpool, as recorded by Mr. Hartnup in the very interesting Tables which he presented to the Dock Board in 1864. The Tables give mean velocities for sixteen points of the compass for each month for the twelve years ending 31st December, 1863. Although, as a record of velocity, these Tables are as complete and as carefully arranged as are any where to be found, they leave with the investigator the desire for additional information; more especially for synchronous records of temperature, barometric pressure, and whether the general movement of the air was cyclonic or otherwise. During cyclonic periods we have great velocity, great relative moisture, warm winter winds, cool summer winds. During anticyclonic periods we have low velocities, great relative dryness, and the extremes of cold in winter and of heat in summer. These important distinctions are concealed under mean velocities. Even when temperatures for different wind directions are recorded, we lose sight of the difference in quality between a cyclonic north or a cyclonic east wind, and winds from the same directions during an anticyclonic period.

The mean velocities of the Liverpool winds, arranged so as to show the seasonal means, are given in the following Table:—

Mean Hourly Velocity of the Wind in Miles at Liverpool for the 12 years ending December 31st, 1863.

Month.	N.	NNE.	NE.	ENE.	E.	ESE.	SE.	SSE.	S.	SSW.	SW.	WSW.	W.	WNW.	NW.	NNW.
March	7·0	6·6	7·1	11·3	10·7	11·3	10·9	11·1	10·1	13·5	17·5	19·1	22·6	20·4	18·3	13·8
April	6·7	6·5	7·6	8·4	11·7	11·1	12·2	10·9	8·0	13·6	18·0	15·8	20·5	18·3	15·4	12·7
Mean	6·85	6·55	7·35	9·85	11·20	11·20	11·55	11·00	9·05	13·55	17·75	17·45	21·55	19·35	16·85	13·25
May	6·8	6·8	9·0	8·7	11·5	9·9	9·6	9·6	9·5	12·3	16·9	16·5	17·3	15·4	12·4	9·7
June	6·7	5·5	7·1	8·9	10·7	9·8	11·2	11·0	11·6	12·1	16·6	15·2	16·4	17·0	14·7	10·3
July	6·9	5·5	5·2	7·7	9·3	9·5	10·3	10·2	9·6	11·6	15·8	14·2	17·0	15·6	13·7	10·4
August	7·9	6·3	7·2	8·6	9·5	9·0	10·3	10·4	10·7	12·5	14·8	14·2	18·2	17·6	15·5	10·7
Mean	7·08	6·03	7·13	8·48	10·25	9·55	10 35	10·30	10·33	12·13	16·03	15·03	17·23	16·40	14·08	10·28
September	6·8	6·2	6·5	7·6	9·3	8·9	10·1	10·3	9·8	11·5	14·2	14·5	17·4	18·7	16·1	12·0
October	7·4	7·1	8·4	9·4	9·6	10·0	10·7	11·0	9·7	11·6	16·7	17·9	19·3	18·0	17·1	14·8
Mean	7·10	6·65	7·45	8·50	9·45	9·45	10·40	10·65	9·75	11·55	15·45	16·20	18·35	18·35	16·60	13·40
November	7·8	5·9	6·2	7·3	9·1	10·9	11·5	11·2	9·7	11·9	18·4	17·7	16·6	20·2	17·7	12·3
December	8·6	6·3	7·0	6·5	9·8	11·3	14·4	12·7	11·8	15·0	18·9	19·5	24·1	22·7	19·5	15·9
January	7·6	6·5	6·3	7·4	10·3	10·2	14·3	13·0	12·5	15·7	18·9	18·7	21·6	23·0	18·6	13·6
February	9·0	6·7	7·1	9·0	12·0	11·0	13·9	12·4	10·4	15·5	17·2	16·5	20·6	22·5	18·2	18·0
Mean	8·25	6·35	6·65	7·55	10·30	10·85	13·53	12·33	11·10	14·53	18·35	18·10	20·73	22·10	18·50	14·95
Mean for the Year	7·43	6·33	7·06	8·40	10·29	10·24	11·62	11·15	10·28	13·07	16·99	16·65	19·30	19·12	16·43	12·05
Difference between Summer and Winter Velocities	+1·17	+·32	−·48	−·93	+·05	+·30	+3·18	+2·03	+·77	+2·40	+2·32	+3·07	+3·50	+5·70	+4·42	+4·67

These velocities for summer, winter, and for the year, when examined by Bessel's formula for recurring phenomena,* give the following equations in which V_n represents the mean velocity at North in miles per hour. The velocity at any other azimuth may be found from this by substituting for the angular measure of that azimuth from north, counting in the direction easterly from north.

ummer Months ..... $V_n = 11{\cdot}29 - 1{\cdot}56\cos\theta - 3{\cdot}83\sin\theta - 2{\cdot}07\cos 2\theta - {\cdot}80 \sin 2\theta - {\cdot}34\cos 4\theta + {\cdot}29\sin 4\theta$ and a remainder.

Winter Months..... $V_n = 13{\cdot}39 - 1{\cdot}56\cos\theta - 5{\cdot}82\sin\theta - 2{\cdot}39\cos 2\theta - 2{\cdot}10 \sin 2\theta - {\cdot}84\cos 4\theta + {\cdot}12\sin 4\theta$ and a remainder.

he whole 12 months .. $V_n = 12{\cdot}33 - 1{\cdot}36\cos\theta - 4{\cdot}82\sin\theta - 2{\cdot}44\cos 2\theta - 1{\cdot}29 \sin 2\theta - {\cdot}61\cos 4\theta + {\cdot}11\sin 4\theta$ and a remainder.

For the present purpose it was not desired to continue the examination beyond the quadrantal term. The following are the remainders mentioned in the above equations :—

	N.	NNE.	NE.	ENE.	E.	ESE.	SE.	SSE.
ummer	−·24	−·62	+·10	+·72	+1·06	−1·11	−·47	+·23
Winter	−·35	+·05	+·01	−·32	+1·18	−1·43	+·20	+·43
ear	−·49	−·35	−·23	+·34	+ ·95	+ ·92	−·17	+·33
	S.	SSW.	SW.	WSW.	W.	WNW.	NW.	NNW.
ummer	−·21	−·34	+1·40	−1·01	−·38	−·14	+·73	+ ·15
Winter	−·62	+·91	+ ·82	−1·74	−·03	+·26	− 83	+1·25
ear	+·36	+·17	+ ·98	−1 35	+·32	+·10	−·24	+ ·85

The same particulars are represented graphically in the diagram (Plate I.), which shows distinctly that the remainders represent real quantities, and that their causes are in operation throughout the year. The dotted curves represent the observations, and the line curves the sum of the coefficients so far as calculated.

Speaking broadly, the following may be taken as showing the results with sufficient accuracy :—

1. A constant easterly velocity represented by 4·136 miles an hour in the direction N 68° E in summer; by 6·025 miles an hour in the direction 75° E in the winter; or by a mean velocity of 4·136 miles an hour in the direction N 74° E throughout the year.

2. A constant velocity from each point of the compass modified by a quadrantal term having its maximum *minus* value about N by E and by W, and its maximum *plus* value about E by S and W by N. The values being :—

	Constant Velocity in miles per hour.	Quadrantal Velocity in miles per hour.	Angles of greatest quadrantal effect.
Summer .	11·29	2·22	N 10°·6 E, &c.
Mean of Year	12·33	2·76	N 14° E, &c.
Winter . .	13·39	3·18	N 17°·9 E, &c.

* Quarterly Weather Report of the Meteorological Office. Part IV., 1870. Appendix IV.

The mean values for the year are also represented in the diagram. (Fig. 1.) The mode of construction of this diagram will be illustrated in describing that for representing the force of the wind, to which we now proceed.

FIG. 1.

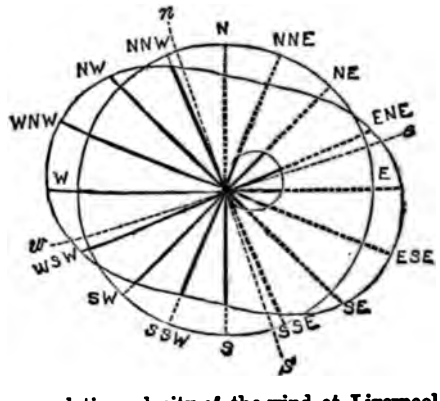


Diagram showing mean relative velocity of the wind at Liverpool from the different points of the compass. The lines inside the small interior circle show the relative velocities of the constant easterly movement of the air on the different points, adding to the velocity of the winds on points to the left of the line *n s*, and decreasing the velocity of the winds on points to the right of the line *n s*. The former are indicated by strong lines, and the latter by bold dotted lines.

The greater velocity of the winds here in winter accords with our ordinary experience, we now also see by the analysis that the separate elements increase in velocity in the same season and in a greater ratio. But the equations from which these facts are deduced, besides formulating in a concise manner a large variety of observations, will, it is hoped, lead eventually to the solution of the physical causes of their several terms. Convert wind velocity into force for each point of the compass, and we have similar data to that which is constantly treated in calculating the direction and amount of the magnetism of an iron vessel from observations of the deviation of the ship's compass as her head is held upon its different points. The chief difference in the two problems is this, that while in the latter a physical cause can be assigned for each of the co-efficients, in the former nothing seems known at present beyond the fact that all the phenomena depend more or less directly upon the sun.

Although it is far from satisfactory to deduce the force of the wind from the mean annual or mean seasonal velocities on the different points of the compass,* it may be worth while, as an approximation only, to try the experiment, and I venture to think that the result as given below may not be

* I am now able to state that if the force of the wind were calculated from the velocity for each hour, instead of from the daily means, the first term in the equation for force would be about one-third larger, and that the other terms would probably remain much the same as stated in the paper.—April 19th.

teresting to the Fellows of the Society. The mean winter winds are ted for this purpose, and the values are taken for each 15° of azimuth, ting from north by way of east, as calculated from the velocity equation dly obtained. The usual mode is adopted of making F (force) $= \frac{V^2}{200}$.

resulting equation for force at north in lbs. on the square foot is
: $1{\cdot}0144 - {\cdot}1283\cos\theta - {\cdot}824\sin\theta - {\cdot}391\cos 2\theta - {\cdot}242\sin 2\theta - {\cdot}038\cos 3\theta$
$51\sin 3\theta - {\cdot}109\cos 4\theta + {\cdot}034\sin 4\theta + {\cdot}012\cos 6\theta$.

ne separate components of the force for each azimuth are given in the e on page 147; the remainders are also given, to show that practically whole of the force is included in the equation.

he force on each point is represented also in the lower part of diagram e VI., and by the dygogram* Fig. 5. This term will be familiar to students ne magnetism of iron ships, and was first employed by the late Archibald ith, M.A., F.R.S.† The following figures 2, 3, 4, will make its mode of

FIG. 2.

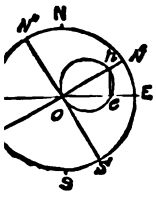


FIG. 3.

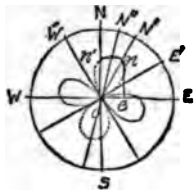
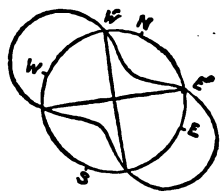


FIG. 4.



truction intelligible. From a scale of equal parts take as radius the first ficient in the equation 1·014 and describe the circle NESW Fig. 2, the will represent the mean pressure of the wind. Next from the same lay off Oe equal to ·824 the force to the E of the second term, and en l to ·128 the force to the N of the second term; through On draw W′N′, lescribe the circle Oen. This line On represents a constant pressure e wind in the direction from O to N′, so that the pressure of the wind W′ to O will be increased by On, and the pressure in the contrary tion from N′ towards O will be decreased by On. In the same way, the ure from any point in the circle to the left of the diameter N″ S′ will creased by so much of the diameter drawn through that point as passes gh the circle Oen; and pressure from any point in the circle to the of the diameter N″ S′ will be decreased by so much of the radius from point as passes through the circle Oen. From this it will be seen that nly pressures which will preserve the mean value will be those in the tion N″O and S′O,—directions at right angles to On. The lines gh the small circle vary as the sine of the angle they make with N″S′, represent a polar force.

ne next term is that depending on cos 2θ and sine 2θ. These are laid

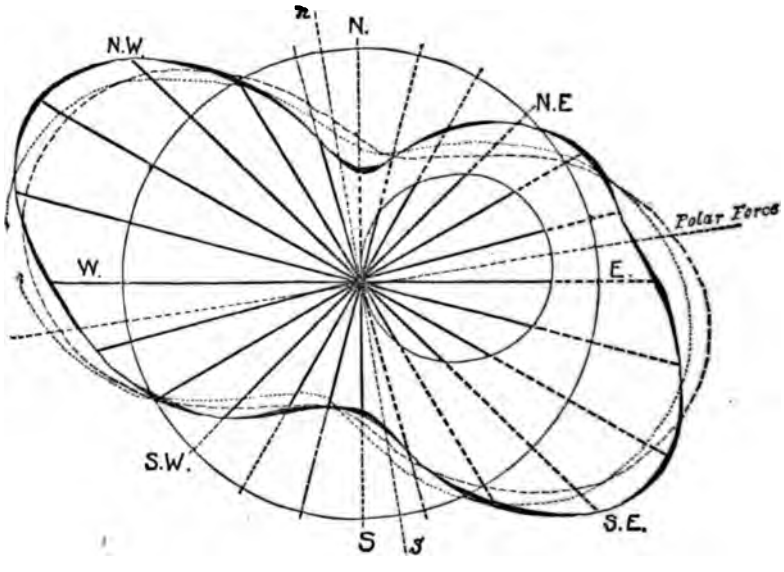
*The term "Dygogram" is a contracted form of "Dynamo-gonio-gram," or "Force angle diagram."

†Admiralty Manual for the Direction of the Compass. 3rd Edition, 1869.

off in the same manner, O e, Fig. 3, being made equal to ·391 and $e\,n$ to ·242, the resultant O n representing the amount of the quadrantal force; but to obtain the direction of its maximum effect we must bisect the angle N O N′, the azimuth from N of the resultant. The nodes or points at which this force becomes 0 will be at 45° and at 135° on each side of the point N." Instead of a circle, as in Fig. 2, we have now only a loop O $n\,n'$; the radii included within it varying as the sine of twice the angle which they make with W′ O or O E′. The similar loops in the other quadrants will bear + and — signs alternately. As these loops would confuse the figure, the forces which they represent may be laid off as in Fig. 4, in which the part of the curve W′ E′ lying within the circle represent the *minus* values, and the parts without the circle represent the *plus* values of the quadrantal force. In the same way the forces depending on 3θ, 4θ, &c., are to be laid off, taking care to divide their resultant angles from N by 3, 4, &c., respectively, to obtain the direction of their maximum values, and also taking care to lay off the co-efficients in the direction contrary to their signs.

Dygogram Fig. 5 is constructed by the method now described, and in it the dark lines show the forces for the points on the left of the diameter $n\,s$ at right angles to the resultant of the polar force, and the dark dotted lines show the forces on points to the right of this diameter.

FIG. 5.



The radii of the large circle NS represent the mean pressure of the wind. The small circle represents the effect on the pressures from the different points of the compass of the constant pressure in the direction marked "polar force." The effect of the quadrantal term is represented by the line dotted thus - - - - -, and that of the sextantal term by the line dotted thus ..... The remaining line shows the joint effect of all the smaller terms on the mean pressure from the different points of the compass; the thickened part of this line represents alternately the plus and minus effect of the dodecantal term.

— 1·56 cos θ — 5·82 sin θ — 2·39 cos 2 θ — 2·10 sin 2 θ — ·84 cos 4 θ + ·12 sin 4 θ. Also the calculated pressure of the wind on the same points in lbs. on the square foot as represented by the equation F_N = 1·0144 — ·1283 cos θ — ·824 sin θ — ·391 cos 2 θ — ·242 sin 2 θ — ·038 cos 3 θ — ·061 sin 3 θ — ·109 cos 4 θ + ·034 sin 4 θ + ·012 cos 6 θ.

Azimuth.	Velocity. Miles per hour.	Force in lbs. on sq. ft. Vel.² / 200.	Mean Force in lbs.	Units of ·001 of a lb.									Force in lbs. on the square foot.	
				Polar.		Quadrantal.		Sextantal.		Octantal.		Do-decantal.	Sum of last 10 columns.	Difference between last column and column three.
				Cosine values.	Sine values.	Cosine values.	Sine values.	Cosine values.	Sine values.	Cosine values.	Sine values.	Cosine values.		
N	8·60	·3698	1·0144	—128	0	—392	0	—38	0	—109	0	12	·359	·011
N 15° E	6·89	·2374	do.	—124	—213	—340	—121	—27	43	—55	33	0	·210	·027
N 30° E	6·59	·2172	do.	—111	—412	—196	—209	0	61	55	33	—12	·223	—·005
NE	6·91	·2388	do.	—91	—583	0	—242	27	43	109	0	0	·277	—·038
N 60° E	7·31	·2672	do.	—64	—714	196	—209	38	0	55	—33	12	·295	—·028
N 75° E	7·91	·3129	do.	—33	—796	340	—121	27	—43	—55	—33	0	·300	·013
East	9·12	·4159	do.	0	—824	392	0	0	—61	—109	0	—12	·400	·015
N 105° E	10·93	·5973	do.	33	—796	340	121	—27	—43	—55	33	0	·620	·023
N 120° E	12 63	·7976	do.	64	—714	196	209	—38	0	55	33	12	·831	·033
SE	13·31	·8858	do.	91	—583	0	242	—27	43	109	0	0	·889	—·003
N 150° E	12·81	·8205	do.	111	—412	—196	209	0	61	55	—33	—12	·787	·033
N 165° E	11·89	·7069	do.	124	—213	—340	121	27	43	—55	—33	0	·688	·018
South	11·72	·6868	do.	128	0	—392	0	38	0	—109	0	12	·691	—·004
N 195° E	12·93	·8359	do.	124	213	—340	—121	27	—43	—55	33	0	·852	—·016
N 210° E	15·11	1·1416	do.	111	412	—196	—209	0	—61	55	33	—12	1·145	—·003
SW	17·35	1·5051	do.	91	583	0	—242	—27	—43	109	0	0	1·485	·020
N 240° E	18·95	1 7955	do.	64	714	196	—209	—38	0	55	—33	12	1·775	·020
N 255° E	19·95	1·9900	do.	33	796	340	—121	—27	43	—55	—33	0	1·990	·000
West	20·76	2·1549	do.	0	824	392	0	0	61	—109	0	—12	2·170	—·015
N 285° E	21·37	2·2834	do.	—33	796	340	121	27	43	—55	33	0	2·286	—·003
N 300° E	21·15	2·2366	do.	—64	714	196	209	38	0	55	33	12	2·207	·030
NW	19·35	1·8721	do.	—91	583	0	242	27	—43	109	0	0	1·841	·031
N 330° E	15·93	1·2688	do.	—111	412	—196	209	0	—61	55	—33	—12	1·277	—·008
N 345° E	11·89	·7069	do.	—124	213	—340	121	—27	—43	—55	—33	0	·726	—·019

When a Table like that at page 147 has been prepared, the values on the several azimuths in the Table can be easily laid off on these azimuths in the figure from a scale of equal parts.

The wind force for winter at Liverpool, which has been thus approximately represented, may be broadly described: 1. As a constant force in the direction N 81°·2 E of ·834 lbs. on the square foot, and, 2. As a force revolving round and pressing towards Liverpool equal to 1·014 lbs. on the square foot, but modified by quadrantal and other smaller terms depending on the particular azimuth of the force. Separating the constant force towards N 81°·2 E from the rotating force,—that is, omitting from view the interior circle of the dygogram,—we can see that the principal cause of change in the latter is the quadrantal one, and that the others only partially modify the peculiar form which the quadrantal force gives to the dygogram; but we absolutely know nothing at present as to the proximate causes of these symmetrical changes from change of azimuth. Even as regards the constant force towards N 81°·2 E, it is not unlikely that surface friction may cause some part of it. Possibly the configuration of the land round the Observatory may also modify, if not produce, the quadrantal and smaller terms. We know, for example, that the easterly winds are much stronger on the east coasts of England and Ireland than they are at Liverpool; and it is easy to conceive that the shelter of the land to the east of the Liverpool Observatory, and the open water to the NW of it, may materially influence the force in the quadrantal directions.

It appears evident that only a comparison of the wind force at other stations, in relation to the peculiarities of each station as regards the distribution of land and water, hill and plain, in its vicinity, can enable us to form an opinion as to the effect of such conditions; and that the possibility of this comparison itself must depend very much on the records of the several stations being tabulated in a similar manner. We thus come round again to the questions with which this paper commenced.

There is one feature in this attempt to represent the force of the winter winds of Liverpool to which attention must be directed. In the equation for velocity, from which the equation for force was obtained, there is no term varying as cosine and sine of 3θ, but in the latter equation this term makes its appearance. This creation as it were of a sextantal term deserves notice, as it may assist in the physical explanation of this term when it occurs in other meteorological phenomena; as, for example, when it occurs in the daily inequalities of the barometer. In fact, it supports in a very marked way the hypothesis that these inequalities are caused by ascending and descending currents of air occasioned by changes of temperature. A purely polar change in the velocity of the ascending or descending currents will, of necessity, produce a sextantal term in the pressure, though this term will be much reduced when the polar co-efficient by which it is caused is joined to a large constant, as is actually the case with wind velocity.

Fig. 6 will easily explain the production of the sextantal term from a regularly recurring series in which $\sin^2\theta$ enters. In this figure let the cur-

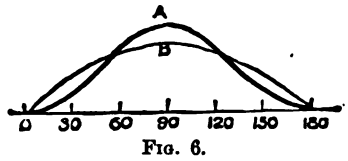


Fig. 6.

A represent one of which the ordinates vary as $\sin^2\theta$, and let the curve B represent one of which the ordinates vary as $\sin\theta$. Let the ordinates to both curves be equal at the angles 0°, 60°, 120°, and 180°, as is represented in the figure. Here it will be at once seen that a sextantal term lies between the two curves, and it is the mean value of this term which is represented by the co-efficient depending on sine 3θ in the preceding equation for wind force at Liverpool.

There are some other features which present themselves in the treatment of a series of terms, varying as $\sin^2\theta$, by Bessel's formula deserving careful attention from meteorologists, but they would be out of place in so elementary a paper as the present.

DISCUSSION.

The President said that the comparatively high velocity of the south-east wind shown in the diagrams and tables was apparently due to the position of Liverpool in the valley of the river Mersey, which there lay from south-east to north-west. In this position winds from a southerly point would frequently be deflected, and follow the course of the river. The flow and ebb of the tide, too, would conduce to the same effect.

Mr. J. S. Harding said that having done some work in connection with the reduction and discussion of anemograms, he ventured to offer a few remarks on the subject of the present paper. Of all the meteorological elements perhaps the wind is the most difficult to treat in a satisfactory manner, it being necessary to take *both force and direction* as well as time into consideration; and its relation to the other elements, *e.g.* pressure, temperature, &c. is not very well defined. The difficulty of the subject is indeed apparent in almost every ordinary printed register, for the force (or velocity) is generally meaned by itself, and the direction left untouched, or treated by itself. In anemometric records, however, the difficulty of dealing with the observations is very considerable for the data for one year necessitate the tabulation of 8,760 observations for direction, and as many for velocity or pressure; and when the first work of tabulation is performed there still remains the question of how to deal with the accumulated mass of figures. The paper just read must create much interest, as Mr. Rundell is well known as a laborious and able investigator; and, as the self-imposed labour of a gentleman engaged in professional duties, it is a marked example of how large an amount of useful work may be done by any one devoting his leisure to a special inquiry. Mr. Rundell's treatment of the subject differed materially in some respects from methods which have been followed generally elsewhere. As an investigation into the winds of Liverpool, more especially with relation to their force or velocity, the paper is most exhaustive; but from the mere reading for a first time it was difficult to say how far the results arrived at might, or might not, be combined with other investigations for arriving at the desired ultimate knowledge of the laws which regulate the general motions of the atmosphere. As he gathered from the reading of the paper, the velocities have been grouped under 16 points of the compass only *irrespective of hours*, and from these the inequalities of the velocities have been treated by Bessel's Interpolation Formula, the processes employed being very lucidly explained. The components

employed, however, are apparently only those deduced from the means given in the Tables. The methods previously referred to, and recommended by Dr. Robinson and others, proceed upon the plan of resolving *each individual hourly tabulation for direction and velocity combined* into rectangular components, and for 32 points of the compass. This method, although perhaps more tedious than that employed by Mr. Rundell, seems more likely to lead to the deduction of general laws of the sequence of the wind both as regards direction and velocity *at any given time*, its dependence on the position of the sun, &c. It is true that the latter method does not clearly show the general distribution of the winds which is popularly looked for, and necessary for many investigations, and the only way of solving the difficulty would perhaps be a combined method, as recommended by Dr. Hann, of Vienna, giving the resultants for each individual day and for each month, and adding, in the monthly results, the frequency of the principal wind directions. The mathematical treatment, by Bessel's formula, if more generally adopted,—being concise in its results,—is more likely to lead to the discovery of laws than a large mass of figures, and the attention drawn by Mr. Rundell to the method of dealing with anemograms will, it is to be hoped, lead to discussion among meteorologists, and to the laying down of a definite plan of operation in other similar investigations.

XIV. *On the Aspiration of the Dry and Wet Bulb Thermometers.* By Samuel H. Miller, F.R.A.S., F.M.S.

[Received March 11th.—Read April 19th, 1876.]

As I had failed, after several attempts, to obtain some relation between the temperature of evaporation, or of that of the dew point, and the amount of evaporation from a surface of water under various conditions, *i.e.* exposed or shaded, I determined, last year, to adopt some method of aspirating the Dry and Wet Bulb Thermometers, in order to secure, if possible, more delicate, and, as I hoped, more accurate readings than are made in the ordinary way. It had occurred to me that on a hot, calm day, the air in the shade might become over-heated—notwithstanding all precautions to the contrary; or that, on a cold, damp day, the air around the bulbs might become surcharged with moisture, and that, therefore, the stagnant air in the shade would not fairly represent the normal state of the atmosphere 4 feet above the ground.

My thermometer-stand is somewhat like a Stevenson's screen, but much larger than that is generally represented; it is 4 feet square, and has a double top, with one inch space between the boards. A raised cap overlaps the upper portion of the top, and thus allows ample space for the air to pass out, without the admission of rain or sunshine. The SE side of this stand is further screened by a large white board, fixed several inches from the side and 8 feet from the ground.

The Aspirator.—For aspirating I have used a water butt, from the top of which is led a pipe bifurcated inside the screen, and terminated by two cups, each having two slits. This pipe is closed by a tap, when not used, so as to cut off all vapour from the butt. A small pump is employed to raise the water from the vessel which receives it from the butt; the great defect of this

THE READINGS OF THE DRY AND WET BULB THERMOMETERS AT 3 P.M.

Date 1875, June.	Non-Aspirated. Dry.	Non-Aspirated. Wet.	Aspirated. Dry.	Aspirated. Wet.	Difference of Dry.	Difference of Wet.	Wind. Direction.	Wind. Force. (0—6)
	°	°	°	°	°	°		
1	71·0	60·8	70·9	60·0	0·1	0·8	NE	0·7
2	74·0	60·0	73·9	59·0	0·1	1·0	NE	1·5
3	75·2	66·0	75·2	65·0	0·0	1·0	N	0·7
4	75·5	67·5	75·7	66·7	+0·2	0·8	W	0·5
5	72·5	60·8	72·9	60·0	+0·4	0·8	SW	0·5
6	73·2	63·3	73·4	62 6	+0·2	0·7	SW	1·5
7	74·2	66·0	74·4	65·3	+0·2	0·7	SW	2·0
8	74·6	61·4	74·9	60·1	+0·3	1·3	W	0·5
9	70·5	62·0	70·6	61·6	+0·1	0·4	SE	1·5
10	55·8	52·2	55·5	52·5	0·3	+0·3	SW	1·0
11	61·2	53·8	61·3	53·0	+0·1	0·8	S	0·2
12	54·5	53·0	54·9	53·0	+0·4	0·0	S	0·2
13	57·5	55·5	57·4	55·1	0·1	0·4	SSW	1·0
14	63·5	57·8	63·9	57·8	+0·4	0·0	SW	2·0
15	60·4	56·3	60·7	55·8	+0·3	0·5	S	2·5
16	57·3	54·5	57·0	54·4	0·3	0·1	SW	0·7
17	62·5	56·3	62·7	55·1	+0·2	1·2	SE	0·3
18	66·5	58·8	66·8	58·2	+0·3	0·6	NNE	0·5
19	70·8	60·8	69·9	58·8	0·9	2·0	S	0·3
20	68·3	61 7	68·7	61·4	+0·4	0·3	NE	0·2
21	62·2	56·4	62 2	54·6	0·0	1·8	SE	0·2
22	67·3	57·9	67·7	57·1	+0·4	0·8	SW	0·5
23	72·0	63·7	72·8	63·8	+0·8	0·1	WNW	0·4
24	72·8	61·3	72·9	61·5	+0·1	+0·2	W	0·3
25	76·5	65 7	77·0	65·1	+0·5	0·6	SW	0·5
26	70·7	59·5	70·8	59·2	+0·1	0·3	WNW	0·4
27	69·2	56 8	69·2	57·0	0·0	+0·2	S	0·1
28	65·3	60·8	65·6	60·6	+0·3	0·2	SE	1·0
29	65·2	63·7	64·9	63·1	0·3	0·6	NE	0·2
30	65·5	63·7	65·9	63·2	+0·4	0·5	W	0·2
Means	67·5	59·9	67·7	59·4	+0·2	−0·5	..	..

THE READINGS OF THE DRY AND WET BULB THERMOMETERS AT 3 P.M.—*Continued.*

Date 1875, July.	Non-Aspirated. Dry.	Non-Aspirated. Wet.	Aspirated. Dry.	Aspirated. Wet.	Difference of Dry.	Difference of Wet.	Wind. Direction.	Wind. Force. (0—6)
	°	°	°	°	°	°		
1	64·6	63·8	64·9	63·8	+0·3	0·0	SE	0·5
2	69·5	62·4	69·9	62·1	+0·4	0·3	SW	1·0
3	63·1	61·6	63·1	61·3	0·0	0·3	N	0·5
4	61·8	56·2	61·7	56·0	0·1	0·2	N	0·7
5	64·4	59·2	63·9	58·8	0·5	0·4	N	0·5
6	71·5	61·2	71·8	61·0	+0·3	0·2	NNE	0·2
7	68·8	60·3	68·9	60·3	+0·1	0 0	E	0·3
8	65·7	59·1	65·8	58·7	+0·1	0·4	NE	0·2
9	59·2	57·3	59·1	57·2	0·1	0·1	S	0·5
10	66·2	57·1	66·1	57·0	0·1	0·1	W	2·0
11	56·5	55·0	56·8	55·0	+0·3	0·0	SW	0·5
12	53·3	51·3	53·2	51·4	0·1	+0·1	W	0·1
13	..	..	..	..	..	..	..	..
14	60·5	56·5	60·4	56·3	0·1	0·2	S	0 2
15	58·7	57·9	59 0	58·0	+0·3	+0·1	E	1·0
16	59·5	57·3	59·8	57·2	+0·3	0·1	NE	2·0
17	65·7	61·0	65·6	61·0	0·1	0 0	N	0·5
18	73·3	68·1	73·5	68·0	+0·2	0·1	E	0·3
19	67·5	66·0	67·5	66·0	0·0	0·0	SE	0·1
20	66·0	65·0	66·2	65·0	+0·2	0·0	SW	0·2
21	65·0	63·1	65·2	63·0	+0·2	0·1	NNE	0·7
22	57·9	56·8	58·0	56·8	+0·1	0·0	SW	0·5
23	66·5	60·8	66·5	60·3	0·0	0·5	SW	0·2
24	65·4	59·3	65·3	59·2	0·1	0 1	W	0·4
25	69·0	54·8	69·3	54·8	+0·3	0·0	SW	0·3
26	64·8	56·6	65·6	56·8	+0·8	+0·2	W	0·2
27	69·3	59·5	69·4	59·5	+0·1	0·0	E	0·3
28	72·7	63·4	72·3	62·5	0·4	0·9	NE	0·2
29	74·5	65 7	74·7	65·3	+0·2	0·4	N	0·2
30	67·4	59·9	67·1	60·0	0·3	+0·1	NNE	0·5
31	63·0	55·1	62·7	54·8	0·3	0·3	N	1·2
Means	65·0	59·7	65·1	59·6	+0·1	−0·1	..	..

THE READINGS OF THE DRY AND WET BULB THERMOMETERS AT 3 P.M.—*Continued.*

Date 1875, Aug.	Non-Aspirated. Dry.	Non-Aspirated. Wet.	Aspirated. Dry.	Aspirated. Wet.	Difference of Dry.	Difference of Wet.	Wind. Direction.	Wind. Force. (0—6)
	°	°	°	°	°	°		
1	64·6	56·8	64·4	56·5	0·2	0·3	N	0·7
2	67·5	59·0	67·6	58·3	+0·1	0·7	SW	0·2
3	64·7	58·5	64·9	58·3	+0·2	0·2	NNE	1·0
4	65·5	57·9	65·1	57·7	0·4	0·2	N	1·0
5	62·8	58·2	63·0	58·2	+0·2	0·0	N	1·0
6	65·5	62·5	65·6	62·4	+0·1	0·1	NNE	0·7
7	65·6	64·7	65·9	64·8	+0·3	+0·1	N	0·2
8	69·6	66·7	69·8	66·3	+0·2	0·4	NE	0·2
9	70·6	65·9	70·9	66·0	+0·3	+0·1	SW	1·0
10	71·5	64·1	71·9	64·0	+0·4	0·1	S	1·5
11	72·8	66·1	73·2	65·8	+0·4	0·3	W	1·0
12	67·0	65·7	67·2	65·5	+0·2	0·2	S	0·1
13	68·5	64·7	68·2	64·1	0·3	0·6	N	0·2
14	72·4	65·2	72·6	64·7	+0·2	0·5	SW	0·5
15	71·5	67·7	71·8	67·5	+0·3	0·2	W	0·2
16	82·6	71·1	82·0	70·7	0·6	0·4	SW	2·0
17	79·0	70·3	79·3	70·7	+0·3	+0·4	SSW	0·5
18	70·6	63·2	70·9	63·0	+0·3	0·2	SW	1·0
19	71·5	62·0	71·6	61·3	+0·1	0·7	ENE	0·1
20	70·5	64·5	70·5	63·3	0·0	1·2	N	0·3
21	71·3	60·8	71·8	60·8	+0·5	0·0	WSW	0·5
22	70·6	63·2	70·9	62·5	+0·3	0·7	SW	0·1
23	72·5	61·3	72·5	61·0	0·0	0·3	SW	0·2
24	70·2	70·1	70·4	69·2	+0·2	0·9	SW	0·5
25	70·2	70·2	70·9	70·0	+0·7	0·2	SW	3·0
26	72·8	72·8	72·9	72·9	+0·1	+0·1	SW	2·0
27	70·7	59·6	70·9	59·0	+0·2	0·6	WNW	0·5
28	64·5	60·2	64·7	59·8	+0·2	0·4	NE	0·2
29	62·2	59·3	62·2	58·4	0·0	0·9	NW	0·1
30	65·7	58·7	66·1	58·3	+0·4	0·4	W	1·0
31	61·5	55·9	61·6	55·5	+0·1	0·4	WNW	2·0

THE READINGS OF THE DRY AND WET BULB THERMOMETERS AT 3 P.M.—*Continued.*

Date 1875, Sept.	Non-Aspirated. Dry.	Non-Aspirated. Wet.	Aspirated. Dry.	Aspirated. Wet.	Difference of Dry.	Difference of Wet.	Wind. Direction.	Wind. Force. (0—6)
	°	°	°	°	°	°		
1	67·2	60·0	67·6	59·4	+0·4	0·6	NW	0·1
2	69·4	64·9	69·4	64·7	0·0	0·2	SSW	0·7
3	65·0	61·7	65·2	61·5	+0·2	0·2	W	0·2
4	66·1	58·8	66·1	57·6	0·0	1·2	W	0·8
5	68·5	62·1	68·3	61·2	0·2	0·9	W	0·2
6	69·5	62·7	69·9	62·1	+0·4	0·6	SSE	0·1
7	74·5	64·7	73·9	64·3	0·6	0·4	SSE	0·5
8	67·7	65·6	67·9	65·0	+0·2	0·6	N	0·2
9	68·3	57·7	68·4	56·5	+0·1	1·2	SW	0·8
10	61·5	57·8	61·2	57·3	0·3	0·5	N	0·2
11	65·5	61·7	65·9	61·2	+0·4	0·5	N	0·3
12	63·1	60·7	63·0	60·7	0·1	0·0	NNE	0·5
13	73·5	62·7	73·6	62·2	+0·1	0·5	NE	0·2
14	68·5	60·8	68·9	60·2	+0·4	0·6	NE	0·3
15	68·0	58·3	68·9	59·5	+0·9	+1·2	E	0·7
16	70·6	58·8	70·9	58·8	+0·3	0·0	E	0·5
17	70·2	67·7	70·0	67·0	0·2	0·7	W	0·2
18	79·0	68·4	78·9	68·0	0·1	0·4	N	0·6
19	77·6	66·5	77·9	66·0	+0·3	0·5	SSE	0·3
20	67·5	60·3	67·9	60·1	+0·4	0·2	SW	0·7
21	61·5	59·3	61·5	59·0	0·0	0·3	SW	0·2
22	59·5	59·0	58·9	59·0	0·6	0·0	NE	0·5
23	55·5	51·8	55·7	51·8	+0·2	0·0	ENE	0·2
24	56·5	51·6	56·5	51·8	0·0	+0·2	SE	2·0
25	65·2	59·8	65·5	59·9	+0·3	+0·1	WSW	0·5
26	63·5	59·0	63·7	59·0	+0·2	0·0	S	1·0
27	59·5	53·5	59·6	53·4	+0·1	0·1	SW	1·5
28	57·7	53·0	58·0	53·1	+0·3	+0·1	W	0·7
29	56·3	52·5	56·2	52·5	0·1	0·0	SW	0·7
30	58·5	52·4	58·6	51·8	+0·1	0·6	N	0·2

THE READINGS OF THE DRY AND WET BULB THERMOMETERS AT 3 P.M.—*Continued.*

Date 1875, Oct.	Non-Aspirated. Dry.	Non-Aspirated. Wet.	Aspirated. Dry.	Aspirated. Wet.	Difference of Dry.	Difference of Wet.	Wind. Direction.	Wind. Force. (0—6)
	°	°	°	°	°	°		
1	62·5	59·7	62·6	59·4	+0·1	0·3	S	1·0
2	50·7	50·3	51·0	50·3	+0·3	0·0	W	0·2
3	54·2	51·7	54·1	51·7	0·1	0·0	SW	1·0
4	64·3	61·7	64·5	61·3	+0·2	0·4	WSW	0·7
5	57·5	56·8	57·8	56·7	+0·3	0·1	WNW	0·7
6	58·5	50·8	58·6	50·8	+0·1	0·0	W	1·5
7	58·7	55·5	59·0	55·3	+0·3	0·2	SW	0·7
8	56·6	53·3	56·8	53·2	+0·2	0·1	S	1·0
9	56·7	53·1	57·0	53·0	+0·3	0·1	ENE	0·1
10	51·5	47·8	51·9	47·7	+0·4	0·1	SSE	0·5
11	50·0	47·0	50·1	47·0	+0·1	0·0	W	0·2
12	50·1	46·2	50·2	46·0	+0·1	0·2	WSW	0·2
13	50·5	46·9	50·7	46·7	+0·2	0·2	NE	0·1
14	49·5	49·1	49·6	49·0	+0·1	0·1	NNE	1·0
15	53·2	50·4	53·2	50·4	0·0	0·0	NNE	0·5
16	52·8	50·4	53·0	50·4	+0·2	0·0	NW	0·1
17	53·6	49·9	54·0	50·0	+0·4	+0·1	E	0·2
18	50·0	48·7	50·0	48·5	0·0	0·2	SE	1·0
19	48·6	46·6	48·7	46·5	+0·1	0·1	SE	2·0
20	48·3	47·6	48·1	47·3	0·2	0·3	ENE	1·5
21	58·0	54·4	58·2	54·4	+0·2	0·0	SSE	0·5
22	54·8	52·6	55·0	52·5	+0·2	0·1	SE	0·5
23	50·7	50·0	50·8	50·1	+0·1	+0·1	NE	0·7
24	49·6	46·1	49·7	46·0	+0·1	0·1	NE	0·3
25	51·5	47·0	52·0	46·9	+0·5	0·1	SSE	0·2
26	47·5	43·1	47·4	43·1	0·1	0·0	SE	0·7
27	43·7	42·1	43·8	42·0	+0·1	0·1	E	1·0
28	46·0	42·9	46·0	42·7	0·0	0·2	ENE	0·7
29	46·2	43·2	46·0	43·0	0·2	0·2	ENE	0·3
30	42·7	40·2	42·8	40·0	+0·1	0·2	E	0·4
31	43·2	41·4	43·1	41·1	0·1	0·3	NE	0·1
Means	52·0	49·2	52·1	49·1	+0·1	—0·1	..	..

THE READINGS OF THE DRY AND WET BULB THERMOMETERS AT 3 P.M.—*Continued.*

Date 1875, Nov.	Non-Aspirated. Dry.	Non-Aspirated. Wet.	Aspirated. Dry.	Aspirated. Wet.	Difference of Dry.	Difference of Wet.	Wind. Direction.	Wind. Force. (0—6)
	°	°	°	°	°	°		
1	42·8	39·3	43·0	39·1	+0·2	0·2	E	0·2
2	46·7	43·9	47·0	43·8	+0·3	0·1	SE	1·0
3	50·1	48·9	50·0	48·7	0·1	0·2	SE	0·5
4	56·5	54·4	56·8	54·1	+0·3	0·3	SW	0·2
5	51·4	51·0	51·5	51·0	+0·1	0·0	SW	0·7
6	50·3	49·6	50·3	49·4	0·0	0·2	W	1·5
7	46·5	41·9	46·5	42·0	0·0	+0·1	WSW	0·5
8	41·7	38·0	42·0	38·1	+0·3	+0·1	WNW	0·3
9	39·3	38·7	39·4	38·4	+0·1	0·3	SW	0·2
10	43·2	42·0	43·0	42·0	0·2	0·0	W	1·0
11	44·5	42·0	44·5	42·0	0·0	0·0	WNW	0·7
12	44·5	42·6	45·0	42·3	+0·5	0·3	W	0·2
13	43·5	43·8	43·8	43·7	+0·3	0·1	E	0·5
14	49·5	47·2	49·2	47·2	0·3	0·0	W	1·5
15	45·5	43·1	45·7	43·0	+0·2	0·1	W	0·2
16	45·5	43·6	45·4	43·4	0·1	0·2	SE	0·7
17	47·1	46·7	47·3	46·6	+0·2	0·1	S	0·4
18	55·2	52·5	55·3	52·3	+0·1	0·2	W	0·1
19	51·4	48·9	51·4	48·8	0·0	0·1	WNW	2·0
20	36·5	35·0	36·6	35·0	+0·1	0·0	NW	3·0
21	42·1	39·9	42·1	40·0	0·0	+0·1	N	0·5
22	39·6	38·5	40·0	38·4	+0·4	0·1	N	0·3
23	41·5	39·9	41·3	40·0	0·2	+0·1	NNE	0·2
24	38·8	37·7	39·0	37·4	+0·2	0·3	NE	0·2
25	37·0	35·0	37·0	34·9	0·0	0·1	N	0·2
26	34·6	34·1	34·4	34·0	0·2	0·1	NW	0·1
27	38·1	36·9	38·0	36·7	0·1	0·2	NE	0·4
28	36·4	35·3	36·6	35·1	+0·2	0·2	NE	0·2
29	35·6	34·3	36·0	34·3	+0·4	0·0	NE	0·2
30	30·7	29·0	30·9	29·0	+0·2	0·0	NE	1·5
Means	43·5	41·8	43·6	41·7	+0·1	—0·1	..	..

THE READINGS OF THE DRY AND WET BULB THERMOMETERS AT 3 P.M.—*Continued.*

Date 1875, Dec.	Non-Aspirated. Dry.	Non-Aspirated. Wet.	Aspirated. Dry.	Aspirated. Wet.	Difference of Dry.	Difference of Wet.	Wind. Direction.	Wind. Force. (0—6)
	°	°	°	°	°	°		
1	35·5	32·5	35·7	32·6	+0·2	+0·1	NE	0·5
2	32·6	32·6	33·0	32·5	+0·4	0·1	NNE	0·2
3	34·0	33·3	34·1	33·1	+0·1	0·2	NW	0·2
4								
5			Aspirator frozen.					
6								
7								
8	34·6	32·4	34·5	32·4	0·1	0·0	WNW	0·3
9	34·7	33·9	35·0	33·9	+0·3	0·0	NW	0·2
10	35·8	35·2	36·1	35·2	+0·3	0·0	W	0·2
11	44·4	42·9	44·7	43·0	+0·3	+0·1	NW	0·1
12	43·9	42·6	44·0	42·5	+0·1	0·1	WNW	0·3
13	42·5	41·1	42·7	41·1	+0·2	0·0	W	0·1
14	37·0	36·1	37·3	36·0	+0·3	0·1	SE	0·1
15	34·2	33·5	34·1	33·3	0·1	0·2	SW	0·2
16	38·7	37·9	38·7	38·0	0·0	+0·1	SW	0·1
17	41·5	41·0	41·6	41·0	+0·1	0·0	SSE	0·2
18	43·1	42·5	43·0	42·4	0·1	0·1	S	0·3
19	44·6	44·3	45·0	44·2	+0·4	0·1	S	0·7
20	47·1	45·5	47·0	45·3	0·1	0·2	S by W	2·0
21	44·6	42·3	44·9	42·2	+0·3	0·1	SW	0·7
22	49·8	44·7	50·0	45·0	+0·2	+0·3	SW	2·5
23	46·0	43·4	46·0	43·3	0·0	0·1	SW	0·2
24	49·1	46·7	49·2	46·7	+0·1	0·0	SSW	1·5
25	42·9	40·9	43·1	40·9	+0·2	0·0	W	0·2
26	47·9	46·8	48·1	46·5	+0·2	0·3	W	0·2
27	43·0	42·7	43·2	42·6	+0·2	0·1	SW	0·1
28	44·6	43·0	44·7	43·0	+0·1	0·0	SW	0·2
29	46·4	44·6	46·2	44·3	0·2	0·3	SW	0·2
30	45·6	45·1	45·8	45·0	+0·2	0·1	SW	0·2
31	44·0	42·4	44·2	42·4	+0·2	0·0	S	0·5
Means	41·8	40·4	41·9	40·3	+0·1	−0·1	..	..

is that it cannot be used during frost, but this difficulty I hope to obviate by a *dry* Aspirator.*

The Hygrometer.—The board that carries the thermometers is placed in a frame, in which it can move vertically about 8 inches; and is counterpoised by means of a weight attached to a wire passing over a pulley. On the stem of each thermometer is placed a small disc of india-rubber, which covers the orifice of the cups when the bulbs are dropped into them. The necks of the cups are contracted by a diaphragm, having an aperture smaller than the pipes leading to the Aspirator. This contrivance appeared necessary, in order to bring the air through the slits directly upon the bulbs. About one

* For some time I have had in view the construction of an aspirator by means of a fan and clockwork, but the plan is not yet matured. I want *to draw* the air past the bulbs, not *drive* it, in order to make it impinge upon the bulbs directly from without. I expect to accomplish this at a comparatively small cost.

ic foot of air passes each bulb per minute. The conducting threads of wet bulb pass into one slit, and as the small reservoir moves with the mometers, its mouth remains below the bulb, and the water does not .

he hygrometer used with the aspirator is one of Mr. Casella's make. thermometers were verified at Kew, in August, 1874. The corrections very slight, being—0·1 at 62° and 72° in the dry, and at 92° in the wet. non-aspirated one is by Messrs. Negretti and Zambra. This instrument been verified at Kew since the observations given in the preceding tables e made.

Every reading given in the tables has been corrected where necessary. e observations are those made at 8 p.m. With each observation is re-rded the direction of the wind and its estimated force. When (+) is not ed, (—) is understood.

Some results obtained were not at all anticipated. One was the influence aspiration on the dry bulb. By reference to the tables it will be seen that piration caused its *rise*, except when there was a fresh breeze from N or E. Sometimes with a stiff breeze from SW there was no rise. The eatest *increase* invariably took place when the air was nearly calm, and the eatest *decrease* in the wet bulb at the same time.

The question arises, *does not the proximity of the wet bulb frequently lower dry bulb nearly half a degree?* For it so often occurred that when the y bulb was removed from the influence of the *wet* one, it rose to that tent.

If further observations shall prove this to be the case, one of two plans ust be adopted where delicate readings are desirable, (*a*) either the bulbs ust be separated by a greater distance than usual, or (*b*) aspiration must be sorted to.

I do not know whether to regard the season at which these experiments re made as altogether favourable or not, seeing it was a period of unusually avy rainfall. At all events, I think it did not exaggerate in one way the ects of aspiration,—that is, in the depression of the wet bulb. July, 1875, as a month of heavy rainfall, and we find by reference to Table II., page 6, that the mean temperature of the dew point in that month was 55°·3 by n-aspiration and 55°·1 by aspiration, showing a difference = — 0°·2; while June and August, months of higher temperature, the differences were spectively —1°·0 and —0°·7.

I have registered the effects of aspiration at 9 a.m. for several months, and have also read the hygrometer immediately before aspiration and after it d proceeded for five minutes, and recorded the results of the same, but ve refrained from encumbering this paper with further details.

When the *dry* aspirator is complete, an opportunity may occur to refer iefly to those results.

I.

We obtain the following results from the

	Mean of Non-Aspirated.		Mean of Aspirated.		Difference.	
	Dry.	Wet.	Dry.	Wet.	In Dry Bulbs.	In Wet Bulbs.
	°	°	°	°	°	°
June ...	67·5	59·9	67·7	59·4	+0·2	—0·5
July	65·0	59·7	65·1	59·6	+0·1	—0·1
August ..	69·2	63·4	69·4	63·1	+0·2	—0·3
September	65·8	59·8	65·9	59·5	+0·1	—0·3
October ..	52·0	49·2	52 1	49·1	+0·1	—0·1
November	43·5	41·8	43·6	41·7	+0·1	—0 1
December	41·8	40·4	41·9	40·3	+0·1	—0·1

From the above elements we obtain the following values for

II.—THE DEW POINT.

	From Non-Aspirated Hygrometer.	From Aspirated Hygrometer.	Difference.
	°	°	°
June	53·9	52·9	—1·0
July	55·3	55·1	—0·2
August	58·9	58·2	—0·7
September	54·9	54·3	—0·6
October	46·4	46·0	—0·4
November.....	39·8	39·4	—0·4
December	38·7	38·4	—0·3

By taking individual readings, which give the maxima differences for estimating the dew-point, we find a greater aberration than by using the monthly means. Thus—

III.—DIFFERENCE BY ASPIRATION.

	In Dry Bulbs.	In Wet Bulbs.	Difference in Dew Point.
	°	°	°
June 3	0·0	—1·0	—1·7
„ 8	+0·3	—1·3	—2·4
„ 21	0·0	—1·8	—3·3
July 28	—0·4	—0·9	—1·3
August 20.....	0·0	—1·2	—2·1
September 4.....	0·0	—1·2	—2·2
October 4	+0·2	—0·4	—0·9
November 24	+0·2	—0·3	—0·9
December 26	+0·2	—0·3	—0·8

DISCUSSION.

LE PROF. CANTONI dit, qu'il est faché de n'avoir pu comprendre tous les détails de la savante communication de Mr. Miller. Il croit pourtout qu'il ne sera pas inutile de dire aussi: qu'en Italie le Prof. Belli, il y aura plus de vingt ans, et après M. Buretti et lui-même, ont fait des expériences pour démontre la grande utilité d'agiter l'air (soit par aspiration, soit par soufflement) autour des thermomètres du psychromètre, afin de rendre comparables entres elles les observations,

lorsque même elles sont faites par des thermomètres dont le reservoir offre des formes et des dimensions assez différentes: au lieu que, sans cela, les psychromètres peuvent donner des valeurs bien divers pour l'humidité relative et absolue de l'air. Le psychromètre muni d'un ventilateur à roue, que l'on a adopté dans presque toutes les stations météorologiques de l'Italie, donne promptement, pour des thermomètres usuels, des résultats tout-à-fait semblables à ceux donnés, sans mouvement artificiel de l'air, par un psychromètre ayant les thermomètres d'une extrême promptitude, avec un reservoir cylindrique et très mence.

The President remarked that, in the summer of 1874, he had seen the method advocated by Professor Cantoni for aspirating hygrometers in operation at the Italian Mountain Meteorological Station at the hospice on the Col di Valdobba. This was at an elevation of 8,359 feet above the sea, between Gressorey St. Jean and Riva di Alagna, south of the Lyskamm. The fan which set the air in motion was actuated by clockwork, the motive power being a heavy weight which was wound up previous to an observation, and it continued in motion a considerable time. The plan appeared eminently suitable, for the bulbs of the thermometers, although cylindrical, were far larger than any used in England for meteorological purposes. The scales were engraved on the tubes of the instruments to tenths of a degree centigrade. The instruments were exposed in a balcony on the north side of the building under a louvred chamber, and great care was evidently bestowed on the registration of the observations, which were comprehensive, and made at frequent intervals.

Mr. Symons said that he believed very strongly in the desirability of aspiration, because he thought it very desirable to substitute a constant current for a variable one. He could not understand why an aspirated dry bulb thermometer should read higher than an unaspirated one, but he knew that it did. During the Strathfield Turgiss Thermometer Experiments he had tried the aspiration of a dry thermometer by drawing air over the bulb, and found that it always read 0°·1 or 0°·2 higher than an unaspirated one. He had not found any difficulty in using the aspirator in frosty weather, as he employed salt and water. Aspirated thermometers had been used in balloon ascents by Mr. Welch, Mr. Glaisher and others; this is absolutely necessary, as the observations must be so taken as truly to represent the different layers of air through which the observers passed. [Mr. Symons showed upon the black board the mode by which dry aspiration was secured at Strathfield Turgiss.]

Mr. Whipple said that an artificial element was being introduced into the question of hygrometry, and that it would be difficult to know where to stop. In comparing two sets of dry and wet bulb thermometers of precisely the same size and construction, and (as well as he could judge) having the flow of water to the wet bulbs the same, there was often a difference between them for which he could not account. The greatest difficulty in obtaining concordant observations was experienced near the freezing point. If a current of air of the same velocity as that of the wind blowing at the time could be passed over the bulbs of the thermometers, their readings would no doubt be more correct. A fan had been used at Kew, but it could not be made to work satisfactorily, the draught produced by an india-rubber aspirator being far more controllable.

Dr. Tripe said that, as the rate of evaporation of water from the covering of the wet bulb thermometer must be more rapid when the air passed by it with some rapidity than when the air was still and remained near the bulb more or less saturated with the moisture from it, some system of aspiration would be useful, as it would give more uniform results. Any one can try the effect of aspiration by placing a wetted piece of muslin on the back of the hand, and noting the greater amount of cold caused by increased evaporation when the muslin is aspirated.

Prof. Wild said that he also had made, at the Central Physical Observatory of St. Petersburg, several experiments on the influence of artificial ventilation on the indications of the thermometer and hygrometer. In the first experiments the hygrometer was unprotected and placed on a rotating machine, and read from time to time before and after rapid rotation for three minutes. In a room very considerable differences resulted from this process; but in the open air, always in shade, rather smaller ones, and of such a nature as to point to radiation as their main cause. On this account, in the later experiments one of the ordinary metallic thermometer screens

(the new cylindrical pattern) was employed; the bottom was taken out and replaced by a ventilator, which could be set in rapid rotation by a weight allowed to run down at the side, and thus produced a strong upward current in the screen; the two thermometers (dry and wet bulbs) in the screen were read as before, immediately before the ventilator was set in motion, and during its motion after it had lasted three minutes. These observations were made in the winter and summer of 1875, regularly at noon, and the monthly means give the following results (Jahresbericht 1873-74, p. 38) :—

1875.	Temperature.		Relative Humidity.	
	Before Ventilation.	After Ventilation.	Before Ventilation.	After Ventilation.
	°	°	Per cent.	Per cent.
January	—13·55	—13·39	80·0	79·7
February	— 5·78	— 5·74	81·8	80·4
June	18·34	18·29	64·7	62·8
July	21·87	21·82	53·2	50·1

Hence we find, on the one hand, that the mode of screening the thermometers which was introduced at the end, has sufficiently obviated the ill effects of radiation to enable us to get the true temperature of the air with an accuracy of ± 0°·05 C, and, on the other hand, that the protection against radiation afforded by it is sufficient to give without ventilation the relative humidity with a limit of error not exceeding ± 2 per cent.

This result is confirmed by the experience of Herr Dohrandt in his observations at Nukuss on the Amu Darja with a hygrometer in one of our screens, which, when used with our Tables (which are very close to Regnault's formula), gave the same results as those made with Regnault's condensing hygrometer. A paper on these observations will shortly appear in the 'Repertorium für Meteorologie.'

Le Prof. Cantoni remercie M. Wild des importantes expériences qu'il vient de communiquer. Cependant, il observe, que le pyschromètre à ventilation rapide, adopté en Italie, jouit aussi de la propriété de rendre bien pétits les effets de la radiation sur les thermomètres, autant qu'on l'obtiendrait en tournant en fronde les thermomètres mêmes; mais qu'en outre il amoindri les différences qui seraient dues à un defaut de promptitude, par des reservoirs à dimensions un peu trop grandes. Toutefois M. Cantoni est bien heureux de voir appellée de toutes partes, l'attention des météorologistes sur cette question.

Capt. Toynbee had noticed that the wet bulb readings were sometimes higher than the dry in ships' logs, and he was inclined to think that this arose from a cooling of the dry, owing to its being exposed to moisture from spray of the sea, the dash of rain on its screen, or fog.

Mr. Gaster remarked that it was not necessary that the observations should be taken at sea in order that the wet bulb should read higher than the dry ; nor was it due to the form of screen employed. He could remember distinctly one occasion when observations were taken in nearly every kind of screen at an inland station, and all the wet bulbs read considerably higher than the dry.

Mr. Marriott said that in the returns which were sent in to the Society the wet bulb readings were sometimes higher than the dry. This was frequently the case at one particular station, where the difference had amounted to as much as seven-tenths of a degree. It only occurred in foggy and damp weather, when the dry bulb became covered with moisture. He believed that evaporation then took place from the bulb of the dry thermometer, which being uncovered, was more sensitive than the wet, and consequently read lower.

Dr. Mann said that he had noticed the wet bulb read higher than the dry when a strong very moist wind of high temperature suddenly replaced a cold dry atmosphere around the instruments.

. *On the Storm which passed over the South of England, March 12th,* 1876. By ROBERT H. SCOTT, F.R.S.

[Communicated April 19th, 1876.]

E apology is due for this paper not being preceded by the regular form ceived on such a day." The reason of this is easily explained. The t verbal communication made by me to the Society was on March 15th. I then requested by the Council to prepare a fuller account of the storm, accordingly issued a circular to foreign meteorologists, requesting them supply me with any information that they possessed for the period question.

This circular has met with a most ready and ample response, but at the e when the paper was formally read, not more than one half of the replies been received; and it is only after the lapse of upwards of two months t I have felt myself in a position to chart the information which has been lected.

n this work, and in fact in the whole preparation of the paper, I have most materially assisted by Mr. Frederic Gaster, to whom almost the le of the work is due.

shall proceed, in the first instance, to trace the very remarkable nomena of weather which preceded the disturbance, and shall then treat e storm itself.

he general condition of the weather during the few days antecedent to ch 8th, may be briefly described in the following manner:—The meter was highest in the south of France, and lowest to the north of islands, while well-marked depressions swept from west to east over the e northerly portions of western Europe, causing the barometer to fall w 29 ins. occasionally at the northern stations, and producing westerly s or strong winds as they passed. One of these depressions had just elled away towards Scandinavia on the 7th, but had scarcely done so re the mercury began to fall with great rapidity in the west of Ireland, the change soon extended to the other parts of the British Isles.

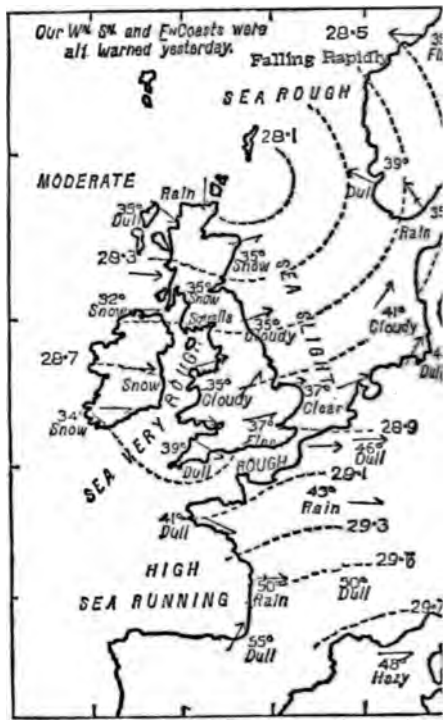
The chart for 8 a.m. on the 8th (fig. 1), showed that pressure varied from ut 30·2 ins. in the south-west of France, to 29·1 ins. at Stornoway, in the brides. The mercury was then falling rapidly in Ireland, which, accom- ied by strong SSW winds and dull wet weather, pointed to the approach nother disturbance from the Atlantic.

By 8 a.m., on the 9th, the centre of the new disturbance lay off the th-east of Scotland, where the barometer had fallen more than an inch, was down to 28·1 ins. in Caithness (see fig. 2). The wind had con- iently veered to W very generally, after having blown a severe gale on our west and north-west coasts, and during the day the centre seems to e moved somewhat to the SE, causing a further fall of the mercury to 9 ins. on our extreme northern coasts.

FIG. 1.

March 8th, 8 a.m.

FIG 2.



March 9th, 8 a.m.

The subsequent course of the depression was erratic, and its motion slow. To the S and SE of its centre, also, there appeared some small secondary disturbances, which, while they lessened the force of the winds over the northern parts of England and Ireland, caused stiff W gales to be felt in the Channel and France.

On the morning of the 10th pressure was highest over Spain and the Mediterranean. The centre of the storm lay not far from the Moray Firth, and NW to N winds had set in along the Irish coasts, while (owing to a continuance of the secondary depression) W gales were felt in the Bay of Biscay. The centre then travelled E, and at 8 a.m. on the 11th it had reached the Skager Rack (fig. 4), but was apparently becoming dissipated by the gradual "filling up" of its centre. Fresh NW breezes blew over the whole of Ireland and England, SW winds in Denmark and Holland, and E in the west of Norway. As the day passed on the barometer continued to rise generally, and the wind fell lighter until the afternoon, when the first sign of the approach of a new storm was given by a slight fall of the barometer at Valencia, accompanied by a return of the wind to SSW, with dull, wet weather (fig. 5). But these changes were very slight, and even at 9 p.m. (when the wind had again backed to ESE at Valencia) the mercury had not

Fig. 3.

March 10th, 8 a.m.

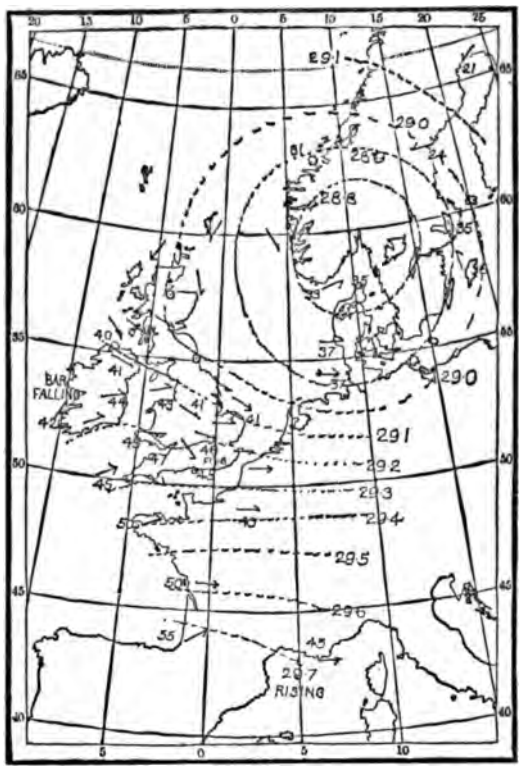
Fig. 4.

March 11th, 8 a.m.

fallen more than 0·18 in. at that station, and in the eastern parts of England it was still rising.

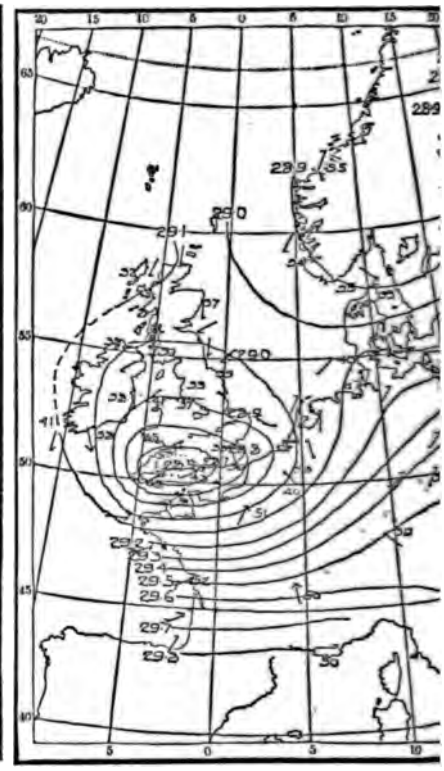
The changes, however, now became rapid, and the next chart which we are enabled to draw, viz. for 8 a.m. on March 12th (fig. 6), shows that the centre of the advancing storm had already reached the south-western counties of England. It will be well to pause here a little and examine this chart more carefully than those which preceded it. It will be seen that the largest depression, which had passed over us between the 8th and 11th, now lay over the more southern parts of Scandinavia, and that the lowest readings at present reported in its centre were very little below 28·9 ins., or not so low by 0·9 in. as those registered on the 9th, when the centre arrived off the north-east coast of Scotland. The motion of the new storm, whose history we are going to trace, was about E, or much the same as that usually followed by secondary disturbances round a primary occupying the position of that which came in on the 8th. It is a question whether the new storm should be considered as secondary to the old one, and in fact it is a point which requires much attention before we can decide what is the precise nature of secondary as distinguished from primary depressions. At present, however, the appearance presented was that of a small but very deep dis-

FIG. 5.



March 11th, 6 p.m.

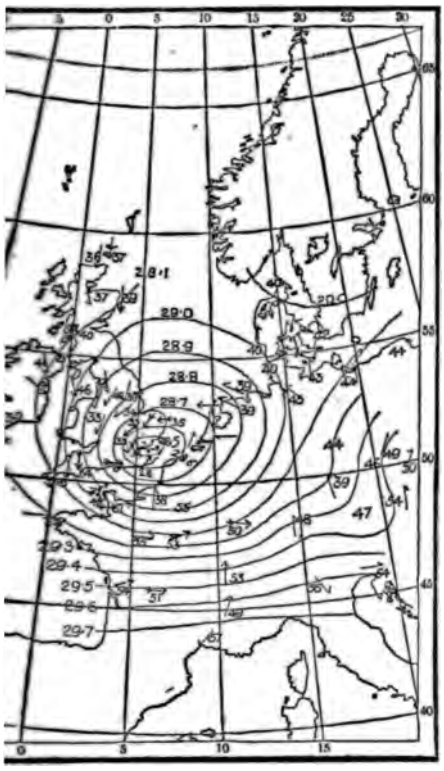
FIG. 6.



March 12th, 8 a.m.

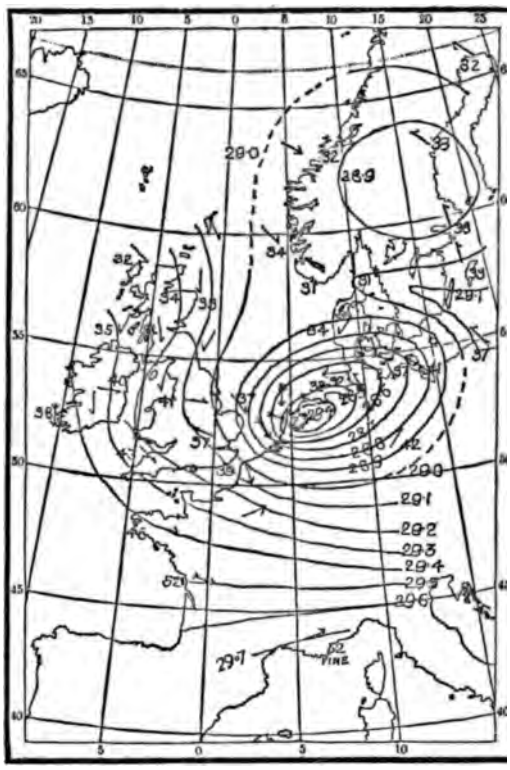
turbance, advancing to the eastward along the southern side of a larger but shallower disturbance, and its effect on the gradients round the larger depression in the north will be apparent at once to any one who examines carefully the chart for 8 a.m. on the 12th (fig. 6). The gradients for NW winds over the North Sea (*i. e.* in the rear of the larger depression) were not only materially reduced, but in the neighbourhood of our Islands they were reversed, and gradients for E winds were established, which accordingly set in during the night. In the Channel and France (*i. e.* to the southward of the centre) the gradients for W winds had been rendered most seriously steeper, and W gales were rapidly spreading over the region they covered. The lowe[illegible] reading we have reported for this hour was 28·62 ins. at Hurst Castle, wher[illegible] however, the mercury was still falling fast, but it will be seen by the cha[illegible] that there was probably much lower pressure over Dorset, &c., which t[illegible] absence of observations for this hour prevents our tracing. At 0·45 p.m. t[illegible] centre was passing to the eastward of London (fig. 7), where the barome[illegible] had reached its lowest point (28·43 ins.), giving an average rate of progre[illegible] of 30 miles an hour between Valentia and London. SW gales were bei[illegible] experienced over Sussex and Kent, and W gales in the Channel and Franc[illegible]

Fig. 7.



March 12th, 0.45 p.m.

Fig. 8.

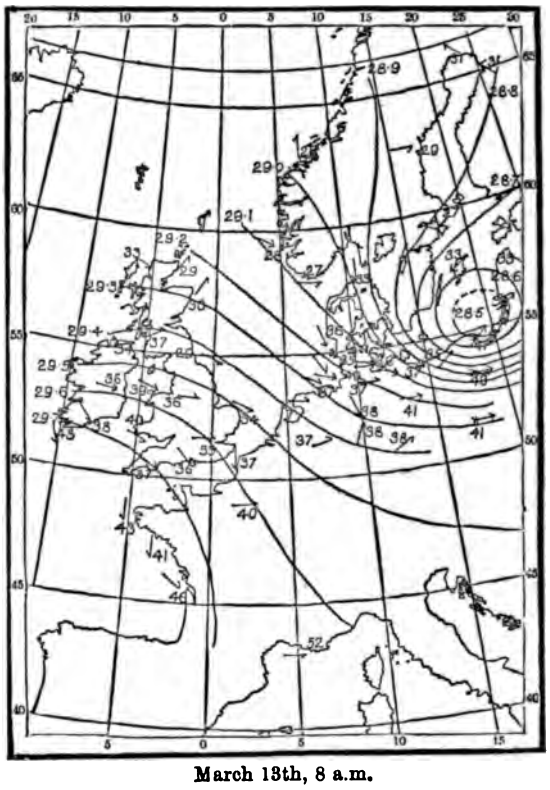


March 12th, 6 p.m.

NE gales were felt to the north of London, and NNW winds were setting in at Kew and over the western suburbs of London generally. In Germany the wind had become generally S to SE and was freshening, while in Holland a strong E wind was rising, and the barometer falling very fast. At 2 p.m. the centre had passed to the east of the mouth of the Thames. Hard NW gales were blowing over our south-eastern counties, severe W gales in France, and E gales in Holland. The barometer was rising with great rapidity at all our south-eastern stations, but still falling rapidly in Holland and North Germany. At 6 p.m. the centre lay over Holland (fig. 8). The wind in our Islands had fallen light. E breezes were blowing in Denmark and over the North Sea, but violent W gales in the southern parts of the Netherlands and north-west Germany.

During the succeeding night the depression continued to advance with rapid strides, and at 8 a.m., on the 13th, its centre had reached the south-eastern portion of the Baltic (fig. 9), where it lay rather to the north of Dantzic, the north-west of Konigsberg, and the west of Memel, giving an average rate of progress of 37 miles per hour since 1 p.m. on the previous day. At all these places the reading of the barometer was almost identical

FIG. 9.



March 13th, 8 a.m.

with that which had been noticed in London as the centre passed over. In fact, the uniformity in the values of the minimum readings recorded at various places lying along the track of the storm is very remarkable.

Accounts of this storm have been published by M. Ernest Quetelet in the Bulletin of the Belgian Academy, Vol. XLI., 2nd Series; by M. C. Sainte Claire-Deville, in the Nouvelles Météorologiques for April 4, 1876; and also by Dr. Neumayer, in the Annalen der Hydrographie und Maritimen Meteorologie, Heft VI., 1876. In this latter paper the rate of progress of the storm is given as follows:—

From the Westward	to	London	25	miles an hour.
,, London	,,	Utrecht	88	,,
,, Utrecht	,,	Emden	69	,,
,, Emden	,,	Hamburg	77	,,

We cannot now inquire into the subsequent progress of the centre, for the observations over Russia, numerous as they are, are too few for this to be done with advantage; but it will be well to notice some of the peculiarities which were observed locally as the storm—so remarkable for its severity—advanced towards and spread over us.

Firstly, with regard to the signs of the approach of the storms from the

tlantic. It will be seen, on referring to the chart for 8 a.m., on the 11th ig. 4), when the large depression over the North Sea was moving away, nat the barometer was still rising over the whole of our Islands and France, oth of which countries were yet under its influence, so that even at our ıost western stations a N breeze was blowing, without any thing to indicate a hange. At 2 p.m. this N wind had died down at Valentia, very light NE breezes were felt, and the barometer showed a *tendency* to fall; but ven at 6 p.m. the fall was so slight, and the other indications (such as wind irection, which was then SW to WSW in Ireland) were so indefinite, that it ould have been impossible to form a correct diagnosis of the coming storm, ven at that hour of the evening. By 9 p.m., however, matters were more ecided, and the isobar of 29·10 ins. which then lay over the southern arts of Ireland, assumed the form of the front part of a depression advancing rom the west, while the wind at Valentia backed again to ESE with rain. hese were the only traces observable at that hour, yet only eleven hours ıad passed before the centre of the storm had actually reached the south-vestern counties of England, and strong SW gales were already blowing in he Channel and west of France. From this country, however, to the ontinent, most valuable information might have been conveyed by wire had he 12th been a week-day instead of a Sunday, but as this was not the case, ur Continental neighbours had but little better chance than we of foreseeing he approach of the storm, and appear to have been equally surprised by it.

So far as the storm itself is concerned, perhaps the most interesting eatures are to be found in the different phenomena experienced in those ocalities which lay immediately in or about its track, and to these we will ıow draw attention. In nearly all parts of England a very brilliant lunar ıalo was seen on the night of the 11th.

At Valentia the minimum pressure (28·97 inches) was recorded at midnight, 11th, but the centre of the storm passed some distance to the southward of hat position, and the wind consequently *backed* round from SE to NE and NNW, with about 0·4 in. of rain. At Roche's Point matters were very similar. Coming further eastward (and to the southward of the storm's track), we find that at Guernsey the night (11-12) was stormy throughout, and at 9 a.m. a stiff SW gale was still blowing accompanied by heavy rain. At Jersey a similar report is made, and the extreme force of the wind (which was SW) is given as 10 by Beaufort Scale. At Plymouth a boisterous night of wind and rain was experienced, and no less than 0·9 in. of rain fell in 6 hours. H.M.S. "Opal," which had left Falmouth for Madeira on the 11th, met a fresh W gale at about 2 a.m. on the 12th, after a rapid fall in the barometer. At 7 a.m. the force increased to 10, and from 8 to 10 a.m. it blew with a force varying from 10 to 11, with violent squalls and a high sea. At 10 a.m. the wind shifted to NNW and soon lulled, while the barometer rose rapidly. Clifton, however, (on the north side of the storm) had a strong NE wind, which at 11 a.m. increased to a strong gale, and snow fell from daylight to 1 p.m. At Hurst Castle the W gale was very severe, force 10 being felt from 10 a.m. to 3 p.m. Cherbourg, and the northern parts of France

all had violent W gales; at Hastings it blew very hard from the SW with rain till the centre passed (1.45 p.m.), and then a NW gale with heavy showers was felt for a short time, followed by a general clear up. In short, the general effects experienced at a little distance on either side of the track of the centre were as follows:—moderate NE gales and heavy snow to the north, subsequently backing to N and NNW as the centre passed, and exceedingly heavy SW to W gales to the south, accompanied by very heavy rains. At stations lying near the centre the wind subsequently shifted to NNW, and blew violently for a short time, with heavy snow. Perhaps, however, the most interesting features were those exhibited in the immediate neighbourhood of the centre's track, and as these appear to have been more minutely recorded in and around London than elsewhere it will be well to refer to them at some length. The centre of the storm appears to have passed directly over London at about 0·45 p.m., and so clearly defined were the limits of the NE and SW currents that at Barnsbury and other places (about 4 miles north of the Thames), ENE winds and snow were felt all the morning, while at Brixton and all places a little south of the Thames the wind shifted to SW for a time during the morning, accompanied by warm rain; and heavy clouds drove with great rapidity from that quarter, while calms or light airs prevailed at the earth's surface. Both at Kew and Greenwich similar changes are reported—the account from Greenwich stating that at 10 a.m. the wind was E and strong, but veered gradually into SE and SW by 11.20 a.m. and fell very light—no pressure being recorded by the pressure anemometer until after 11.30 a.m. After the centre passed, however, the barometer rose with the most extraordinary rapidity, and a NNW storm burst suddenly over the neighbourhood, with violent gusts and torrents of wet snow. An account of the Kew records will be found at page 168. A very little further to the southward (viz. at Croydon) squally SW winds and rain prevailed all the morning, subsequently veering to W and afterwards to NW, when the gale and snow set in. Still further to the southward (viz. at Crowborough Beacon, near Tunbridge Wells) heavy snow fell during the early morning of the 12th, but at 9 a.m. "a violent gale commenced from SW, and at intervals blew a hurricane, with driving rain, snow, and sleet—many trees being blown down." The violence of the NNW wind in the rear of the storm was extreme, but happily of short duration. The SS. 'West Riding,' Captain North, was in Calais Harbour all day, and after a fresh SE breeze at 8 a.m. the wind lulled to a calm; but at 9.15 a.m. it came round to SW and WSW and blew with force 10 (Beaufort Scale), and violent squalls, till a few minutes before 4 p.m., while a slight lull occurred for 5 minutes, followed by "tremendous gusts" of force 11 from NNW but no snow. The mail steamer which had started for Dover had to put back as she was unable to get across.

Although a vast mass of information has been received from Continental stations, it is scarcely so minute in its detail as could be wished, so far as the wind force between the hours of observation is concerned; but as far as can be gathered, the main features of the storm throughout its track were precisely similar to those named above, and it will be seen on referring to fig

3 a.m. on the 13th, (when the centre lay near Dantzig,) that heavy gales were blowing at Dantzig, Konigsberg, and Memel, while a NE as prevailing at Wisby, with snow.

ould be impossible within the limits of an ordinary paper to quote details which have been received, but there still remain a few facts to ed which seem of importance. The first is the low value and uniformity pressure in the actual centre of the storm throughout its track, and traordinary rapidity of the barometric rise as the centre passed off. points seem to have struck every one as much as did the suddenness shift of wind to NNW, its violence while it lasted, and the complete illity of the sky a very few hours afterwards.

ther noteworthy phenomenon is the marked difference between the rature on the N and S sides of the disturbance. On the chart for 8 2th, it will be seen that over central England the thermometer stood at , with a NE wind, while in the Channel and south of England it was as s 48° to 51°. There is, however, a still more striking fact, which shows t close contact these two currents must have been; for at Kew, Brixton reenwich, in the short interval during which the southerly wind pre- , the thermometer rose to 48°, while just in the north of London no ise was recorded, and the cold snowy weather continued until the de- on had travelled far away from our neighbourhood.

der these circumstances it will be readily inferred that the cross currents were of a most complicated nature; and the observations on this t made at Pembroke Lodge, Richmond Park, by the Hon. F. A. R. ll, F.M.S., are so very minute that they may be reproduced here *in o*.

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vations made at Pembroke Lodge, Richmond Park, during the storm of March 12th, 1876.

1 11th, 11 *p.m.* Barometer about 29·03 ins.

12th, 7 *a.m.* Heavy fall of snow, thermometer 34°.

,, 9 *a.m.* Barometer 28·50 ins.; wind fresh from E, with clouds from E, and rain; barometer falling fast, thermometer rising fast.

,, 10.30 *a.m.* Clouds coming fast from WSW, wind still E and ESE, gentle. After about an hour or less the wind changed to the clouds' direction, viz. WSW and SW.

,, 11·30 *a.m.* Clouds and wind SW. Nearly calm.

,, *Noon.* Strong SW wind and clouds from SW, with hard rain. Thermometer 44°.

,, 0.20 *p.m.* Strong SW wind and clouds SW. Barometer 28·33 ins.

,, 0.30 *p.m.* Barometer 28·33 ins. At this time the wind changed suddenly to NW and NNW, bringing dark masses of cloud and London smoke driving at a furious rate from NNW

between the earth, where the wind was NNW, and the higher *nimbus*, which still moved from WSW.

March 12th, 0.40 *p.m.* Wind NNW, with clouds driving tremendously fast, still at right angles to the higher strata, which could with difficulty be occasionally seen for a moment through the breaks. About this time a snowstorm of very great severity began, and lasted an hour. Thermometer 36°.

" " 0.50 *p.m.* Gale from N. Nimbus above the scud moving slowly from SW and WSW. Barometer 28·33 ins.

" " 1 *p.m.* Gale from NNE; lower clouds NNW to NNE; upper nearly motionless, if not quite.

The wind gradually backed to NNW and NW, and the afternoon was fine.

REPORT FROM KEW OBSERVATORY.

FURNISHED BY G. M. WHIPPLE, B. Sc.

"The storm of March 12th may be said to have first affected the Kew self-recording instruments at 0.30 a.m., a period of about 12 hours before it reached its culminating point. At this time the barometer began to fall; the wind shifted from WSW to SSW, and the electrometer showed a diminution in the positive electricity of the atmosphere. At 1.20 a.m. a farther movement of the wind took place, the direction becoming SSE, the velocity then began to increase, and the direction to back until 6.30 a.m., when it settled in the E.

"From 4 a.m. there was a steady fall of rain, which lasted without intermission until 1.30 p.m.; with the commencement of the rain the electricity became strongly negative, returning again to positive between 6 and 8 a.m., the temperature curve rose very regularly from sunrise, and was so closely followed by the wet bulb curve as to show that the air was nearly saturated with moisture.

"The barometer reached its lowest point (28·455in.) about 12.20 noon, and at the same instant the thermometer curves terminated their upward movement in a very remarkable abrupt cusp, the temperature falling in 10 minutes from 48°·5 to 39°·5, and in the 10 minutes succeeding (0h. 20m. to 0h. 30m.) from 39°·5 to 36°·4. Simultaneously with this, the wind, which at noon had veered from ENE through S to W, suddenly became N, and its velocity increased from 10 miles to 25 miles per hour, and the electrometer curve for the time showed an instantaneous change from strong negative to strong positive electricity.

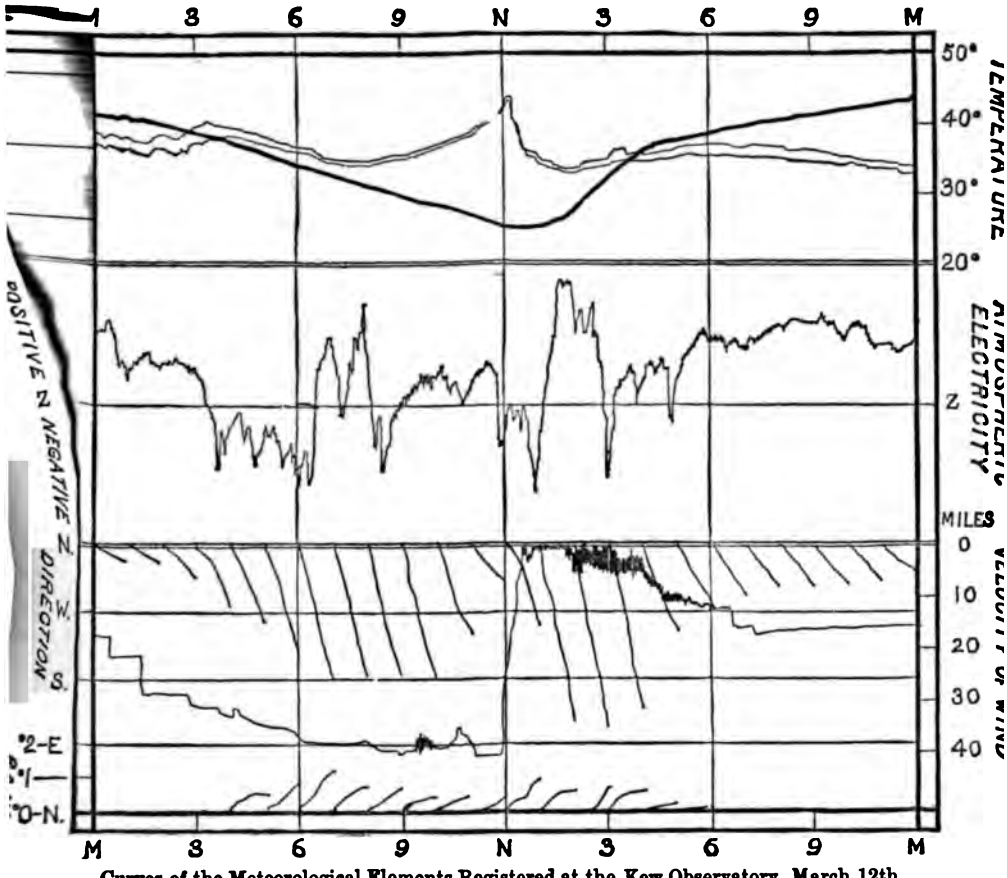
"The barometer rose rapidly until 4 p.m. at an average rate of about ·005in. per minute, the wind continued to blow strongly from the NNW, and steady rain fell from 2.30 p.m. accompanied by a diminution of positive electricity.

"After 4 p.m. the rain ceased, the temperature became stationary at about

35°, and the wind gradually backed to W, the velocity diminishing to 10 miles per hour; the barometric movement continued to be upward, but at a considerably reduced rate, and the electrometer curve indicated increasing positive tension until 6 p.m., when all the instruments resumed their normal conditions, showing the influence of the storm to have completely passed off.

"The amount of rain registered during the transit of the storm was 0·775 in."

FIG. 10.



Curves of the Meteorological Elements Registered at the Kew Observatory, March 12th, 1876.

Fig. 10 shows the course of the curves for Pressure Temperature (Dry and Wet Bulb), Rain, Wind (Direction and Velocity) and Atmospheric Electricity.

This is, as far as I know, the first occasion that an Electrogram from Thomson's electrometer has been reproduced in connection with other automatic records. It will strike every one that the general accordance, in their respective courses, of the electrogram and the direction of the wind is most remarkable, the electricity changing from positive to negative as the wind backed, and returning towards positive as it veered.

KEW OBSERVATORY.

BAROGRAPH READINGS MARCH 12TH, 1876.

Time.	Reading.	Time.	Reading.	Time.	Reading.
Hour. Min.	In.	Hour. Min.	In.	Hour. Min.	In.
2 a.m. 0	29·128	Noon 50	28·461	3 p.m. 40	28·923
10 0	28·598	1 p.m. 0	·458	,, 50	·940
,, 10	·585	,, 10	·461	4 0	·966
,, 20	·573	,, 20	·477	,, 10	28·985
,, 30	·568	,, 30	·500	,, 20	29·006
,, 40	·557	,, 40	·517	,, 30	·027
,, 50	·536	,, 50	·542	,, 40	·041
11 0	·524	2 0	·556	,, 50	·048
,, 10	·501	,, 10	·595	5 0	·052
,, 20	·492	,, 20	·650	,, 10	·065
,, 30	·487	,, 30	·698	,, 20	·074
,, 40	·477	,, 40	·736	,, 30	·083
,, 50	·474	,, 50	·787	,, 40	·097
Noon 0	·471	3 0	·808	,, 50	·110
,, 10	·468	,, 10	·837	6 0	·116
,, 20	·455	,, 20	·863	Mar. 13.	
,, 30	·457	,, 30	·896	8 a.m. 0	·588
,, 40	·460				

THERMOGRAPH READINGS, MARCH 12TH, 1876.

Time.	Dry.	Wet.	Time.	Dry.	Wet.	Time.	Dry.	Wet.
Hour. Min.	°	°	Hour. Min.	°	°	Hour. Min.	°	°
8 a.m. 0	34·0	33·7	10 a.m. 50	38·0	37·7	1 p.m. 30	33·4	33·0
,, 10	34·2	33·9	11 0	38·1	37·8	,, 40	33·0	32·6
,, 20	34·3	34·0	,, 10	39·2	38·9	,, 50	33·0	32·7
,, 30	34·7	34·1	,, 20	39·6	39·1	2 0	32·9	32·7
,, 40	34·9	34·4	,, 30	40·1	39·7	,, 10	33·7	33·2
,, 50	35·0	34·7	,, 40	40·5	40·1	,, 20	34·2	33·3
9 0	35·1	34·8	,, 50	41·1	40·6	,, 30	34·2	33·4
,, 10	35·2	34·8	Noon 0	41·5	41·1	,, 40	34·2	33·4
,, 20	35·3	35·0	,, 10	43·5	43·1	,, 50	34·5	33·6
,, 30	35·5	35·2	,, 20	39·5	39·0	3 0	34·7	33·9
,, 40	35·9	35·5	,, 30	36·4	35·9	,, 10	35·0	34·1
,, 50	36·2	35·9	,, 40	35·7	35·1	,, 20	35·9	34·3
10 0	36·4	36·0	,, 50	35·3	34·6	,, 30	36·0	34·4
,, 10	36·8	36·3	1 p.m. 0	34·9	34·0	,, 40	36·0	34·3
,, 20	37·1	36·7	,, 10	34·1	33·5	,, 50	35·5	34·2
,, 30	37·2	37·0	,, 20	34·0	33·2	4 0	35·4	34·0
,, 40	37·6	37·1						

From these data (which agree remarkably well with what was observed in Brixton a little later on) it appears that over the south-west of London the SW wind showed itself first in what is ordinarily known as the lower stratum of clouds, and subsequently extended downwards to the surface of the earth; while the violent NNW and N currents in the rear of the storm appeared first as surface currents (at 0.30 p.m.), with *very* low driving scud, but did not extend to the higher strata till much later. It would be worse than useless to attempt to form any theory on the discussion of the phenomena presented by a single depression, and that a depression showing many exceptional characteristics. In some ways the disturbance appears to have conformed to

the ordinary movements of the shallow "satellite" depressions which appear round most of the larger disturbances which cross our area, while its magnitude and severity claim for it a higher place in the category than that of a "secondary" disturbance, but it may be safely asserted that it must be useful to consider, as we have now done, the main features of a gale so thoroughly well marked in its details, even at the risk of being a little tedious to those who look for immediate results. It is highly important that many such gales should be carefully followed out, and a very strong effort be made to detect the conditions under which such disturbances appear. So far from too many storms being discussed, it seems that not nearly enough has been hitherto done in this direction. It must be evident to those who consider the matter carefully that it is in this direction we must look for such a devolopment of our knowledge of the laws of storms, as shall enable us to issue more valuable storm warnings to our coasts. We have already pointed out that ample warning might have been telegraphed from England to Germany and the other countries lying to the east of the North Sea, and this is true of most gales, but the serious question for us in the British Isles is "Who is to warn us?" We can get no information from the Atlantic, and it is therefore with increased earnestness that we must look forward to gaining better knowledge of the causes of such storms, in order to give us the information which our geographical position denies us.

The information contained in the replies received to the circular already mentioned is so copious that it would not be possible to reproduce it here, but the observations have been reduced to English measures and tabulated, and the sheets will be deposited in the Society's Library. The following is a list of the gentlemen, in addition to the observers in connection with the Meteorological Office, who have kindly furnished information for the foregoing investigation:—

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Cambridge Observatory	H. Todd.
†Camden Town	G. J. Symons, F.M.S.
*Cardiff	W. Adams.
*Carmarthen	G. J. Hearder, M.D.
Chatham	Capt. Fellowes, R.E.
Chigwell Row	J. Campbell, M.D.
Clifton	G. F. Burder, M.D., F.M.S.
Cooper's Hill (C.E. College)	H. McLeod, F.C.S.
Crowborough Beacon (Sussex)	C. L. Prince, F.R.A.S., F.M.S.

* The information from these Stations was supplied by the Meteorological Society.
† The information from these Stations was supplied by Mr. G. J. Symons, F.M.S.

BRITISH AND IRISH CONTRIBUTORS.—*Continued*

Dublin	J. W. Moore, M.D.
Durham University Observatory	G. A. Goldney.
Folkestone	Rev. C. J. Taylor.
*Forest Hill	E. E. Glyde, F.M.S.
†Framfield (Sussex)	Capt. T. G. Drake, R.N.
†Geldeston (Beccles)	E. T. Dowson.
Glenalmond	Rev. W. P. Robinson.
Greenwich Observatory	W. Ellis, F.R.A.S., F.M.S.
Guernsey	S. E. Hoskins, M.D., F.R.S., F.M.S.
Hastings	A. E. Murray, F.M.S.
Helston	M. P. Moyle, F.R.C.S.
*Hereford	T. A. Chapman, M.D.
† ,,	E. J. Isbell.
Hull	W. P. Mackay, M.D.
Jersey	J. C. Vibert, M.A.
Killingholm	Rev. J. Byron, M.A., F.M.S.
Leicester (Town Museum)	W. J. Harrison, F.G.S.
*Llandudno	J. Nicol, M.D., F.M.S.
Lutterworth (Ashby Parva)	Rev. W. C. Ley, M.A., F.M.S.
Maida Vale (London)	K. J. Marks, F.M.S.
Markree Castle (Sligo)	A. Doberck.
*Marlborough	Rev. T. A. Preston, M.A., F.M.S.
Nottingham	E. J. Lowe, F.R.S., F.M.S.
†Notting Hill	A. North, F.M.S.
'Opal' H.M.S. (Plymouth)	J. K. Laughton, F.R.A.S., F.M.S.
Oscott (St. Mary's)	Rev. S. Whitty, S.J.
Oxford	Rev. R. Main, M.A., F.R.S.
*Ramsgate	Rev. T. H. Quelch, O.S.B.
Richmond Park	Hon. F. A. R. Russell, F.M.S.
Rosenallis (Ireland)	J. Conroy, F.M.S.
Rugby	T. N. Hutchinson, M.A.
Seaham	G. H. Aird.
Shetland (Bressay Sound)	Capt. D. Gray.
Silloth	Rev. F. Redford, F.R.S.E., F.M.S.
Southport	J. Baxendell, F.R.A.S.
*Strathfield Turgiss	Rev. C. H. Griffith, F.M.S.
*Teignmouth	G. W. Ormerod, M.A., F.M.S.
*† Watford	J. Hopkinson, F.M.S.
'West Riding' (in Calais Harbour)	Capt. North.
Winchester	Rev. G. Richardson, M.A.

* The information from these Stations was supplied by the Meteorological Society.

† The information from these Stations was supplied by Mr. G. J. Symons, F.M.S.

FOREIGN CONTRIBUTORS.

Paris	U. J. LeVerrier.
,,	C. Sainte-Claire-Deville.
St. Petersburg	Dr. Wild
Austria	Dr. C. Jelinek.
Holland	Dr. Buys Ballot.
Copenhagen	Capt. N. Hoffmeyer.
Hamburg	Dr. Neumayer.
Heligoland	Dr. Friedrichs.
Emden	Dr. Prestel.
Leipzig	Dr. Bruhns.
Strasburg	Dr. Winnecke.

DISCUSSION.

THE PRESIDENT remarked that on the evening of the 11th of March a brilliant lunar halo was visible for several hours in the neighbourhood of London, in uniform cirro-stratus, having the appearance of ground glass. He had observed several features of the storm at Croydon, an account of which might prove interesting to the Meeting. At daybreak on the 12th a moderate gale was blowing slightly south of east, with snow and sleet, the clouds moving quickly from that quarter; and the temperature of the air was 33°. About 10.25 a.m. the sleet was succeeded by thin rain, the sky became lighter, the distance clear, and the clouds broken towards the southern horizon, where shortly after it was apparent, from the direction of the scud, that a gale of wind was prevailing from the west. Meanwhile the surface current, the clouds in the zenith, and to the north, all came from the east. By degrees the westerly wind crept northward, and in the course of ten minutes the phenomenon was presented of a sky entirely covered with cirro-stratus and low scud, drifting rapidly from the west, while a steady surface breeze was blowing from the east; and the sound of church bells in the distant west rose and fell fitfully with great distinctness. This was terminated about 10.45 a.m., when a column of smoke, which up to the instant had been borne along at a rate estimated at ten miles an hour from the east, was taken aback by a blast of wind from the opposite direction. The air became soft and balmy, the temperature rose rapidly, and in a few moments there was a heavy gale from the west, and occasional gleams of sunshine and showers. The reading of the barometer reached its lowest point (28·45 inches reduced to 32° and sea level) at 12.30 p.m. Ten minutes later the sky grew very gloomy in the north, the wind moderated and veered to NNE, bringing with it first a considerable amount of London smoke, and then a heavy snow-storm. The wind soon increased greatly in force, the barometer rose rapidly, and the temperature fell from 48° to 32°·5. It was worthy of remark that on this occasion the change in the direction of the wind first appeared in the surface current, which, as the storm moderated, gradually backed to WNW by 5.15 p.m., when a few broken remains of cirro-strati moving from the north were the sole lingering traces of the disturbance.

Mr. BUDD said on that day, being at Brighton, he watched the storm from the end of the pier. The violence of the gale was very great, and tremendous waves rolled in parallel with the shore. At about 1.30 p.m. the wind was still from SW, and blowing with unabated force, but he observed the clouds at the same time drifting rapidly from the NW. In ten or fifteen minutes afterwards the surface wind suddenly shifted to the latter quarter, accompanied with a considerable fall of temperature. The effect was very striking; for the crests of the waves were caught along their length and the spray driven off like wreaths of snow. As the wind soon veered further north, the waves were held back, as it were, and the sea being quite muddy, the appearance was that of a series of sand hummocks. Another point was the rapidity with which the sea went down, although it did considerable damage when at its height.

Mr. LAUGHTON said he had received a letter from an officer of the 'Opal,' the corvette which had to put back into Plymouth on account of the damage she sustained. His correspondent described the gale as at its height between 9 and 10 a.m., during which time the ship was lying to,—the wind at NNW, of force 11. The barometer, which had fallen comparatively gradually to 28·80 in., rose by noon to 29·26 in., that is through 46-100ths, the thermometer at the same time falling 8°, from 52° to 44°.

Mr. HARRIS said that the following were his notes on the weather prevailing at Worthing on March 12th:—After midnight wind veered to SE, and by 2 a.m. the barometer had fallen 0·175 in.; between 3 and 5 a.m. heavy and ordinary rain from SE. About 8 a.m. wind veered SW and W, gradually increasing in force. By 9 a.m. the mercury had fallen 0·533 in. since 2 a.m., and 0·706 since 9 p.m. of yesterday. The force of the wind at 10.30 a.m. was at a steady rate, equal to 36 miles per hour. The sea now commenced to run very high (there being yet at least two hours before "high water" would be reached); wind increasing in force from W and WSW; before 12 noon the waves were over the beach and parade, and on to the sea road. Up to 1 p.m. the wind continued blowing with great force, sea running very high and breaking quite on the shore, the mercury still falling, reaching its lowest point, 28·422 in., at 1.30 p.m. Shortly before 2 p.m. wind suddenly veered WNW, and at 2 p.m. it was NW, being very strong and squally: there was a sharp fall of snow and sleet at this time. The barometer now rose very quickly: in one hour the mercury had risen 0·260 in., and at 4.30 p.m. it had risen 0·607 in. in three hours. From 2.30 p.m. till 5 p.m. it blew with great violence from NW and NNW, but by the evening it had backed again to WNW and W. From 10.30 a.m. to 2.30 p.m. the anemometer recorded 273·3 miles of wind, being equivalent to a rate of about 45·5 miles per hour. At the time of observing at 2.30 p.m. the rate was equal to 24 miles per hour.

Mr. ELLIS exhibited a diagram showing for the 12 hours, from 6 a.m. to 6 p.m. on March 12th, the variations of pressure, temperature, and direction and velocity of the wind, taken from the photographic and other self-registered records of the Royal Observatory, Greenwich. He said that at noon of the preceding day, March 11, the wind was W, and so remained till 7 p.m.; during the next 13 hours it backed gradually by S to E, reaching the latter point by 8 a.m. March 12th. At this time the barometer was low and steadily falling, the temperature being 33°. Between 8 and 11 a.m., the barometer still falling, the wind shifted a little to the S of E, and the temperature began to rise considerably. Between 11.15 and 11.35 a.m. the wind gradually shifted from SE to SW, remaining about SW till 0.40 p.m.; this SW wind was accompanied by an increased rise of temperature, which reached its maximum of 46° soon after noon. And now occurred the striking circumstance of the day. At about 0.40 p.m. the wind changed suddenly from WSW to NNE; this was followed by an almost immediate return to WSW, with a final change to N; the first change from WSW to the final change to N occupying about 10 minutes, or from 0.40 to 0.50 p.m. The fall of the barometer had been going on uniformly to this time, the reading reaching a minimum of 28·26 in.* at 0·45 p.m., but the fall was now suddenly checked, and a sharp rise set in, the temperature beginning rapidly to decline. These simultaneous changes of wind to N, increase of pressure and decrease of temperature, were very strongly marked. Between 0.50 and 1.20 p.m., the temperature fell, according to the photographic register, nearly 10°; at 2 p.m. it had descended to 34°, at which point nearly it remained during the rest of the day. The succeeding barometric change was also remarkable; between 2 and 3 p.m. the reading increased 0·26 in.; at 4 p.m. it had reached 28·78 in., having altogether increased 0·52 in. in 3h. 15m. or since 0.45 p.m. Afterwards the increase was more gradual. The wind continued N till 4 p.m., but between 4 and 6 p.m. it backed gradually from N to W, remaining W nearly during the rest of the day. As regards violence of the wind, the pressure was considerable between 8.30 and 10 a.m., and again after 11 a.m.; in the sudden change of wind occurring at 0·45 p.m. there was less violence, but at 1.30 p.m. the pressure again increased, and between 2 and 3 p.m. pressures varying from 10 lbs. to 25 lbs. on the square foot were eight times recorded; after 3 p.m. the wind began steadily to decrease in violence. Although

* Corrected for temperature, but not reduced to sea level; altitude of cistern 159 feet.

e ordinary movements of the shallow "satellite" depressions which appear nd most of the larger disturbances which cross our area, while its magnitude d severity claim for it a higher place in the category than that of a econdary" disturbance, but it may be safely asserted that it must be useful consider, as we have now done, the main features of a gale so thoroughly ell marked in its details, even at the risk of being a little tedious to those who ok for immediate results. It is highly important that many such gales should e carefully followed out, and a very strong effort be made to detect the conditions under which such disturbances appear. So far from too many storms eing discussed, it seems that not nearly enough has been hitherto done in his direction. It must be evident to those who consider the matter carefully hat it is in this direction we must look for such a devolopment of our nowledge of the laws of storms, as shall enable us to issue more valuable torm warnings to our coasts. We have already pointed out that ample varning might have been telegraphed from England to Germany and the ther countries lying to the east of the North Sea, and this is true of most gales, but the serious question for us in the British Isles is "Who is to varn us?" We can get no information from the Atlantic, and it is therefore with increased earnestness that we must look forward to gaining better knowledge of the causes of such storms, in order to give us the information which our geographical position denies us.

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* The information from these Stations was supplied by the Meteorological Society.

† The information from these Stations was supplied by Mr. G. J. Symons, F.M.S.

SUMMARY OF OBSERVATIONS MADE AT STANLEY, FALKLAND ISLANDS, DURING 1875.

By F. E. Cobb.

Months.	Temperature.									Humidity. (0—100)	Rain.		Amount of Cloud.
	Maximum.	Date.	Minimum.	Date.	Average Max.	Average Min.	Dew Point.	Maximum in Sun.	Minimum on Grass.		Amount.	No. of Days it fell.	
	°		°		°	°	°	°	°		In.		
January	64·0	20	36·0	25	55·5	42·6	41·9	150·5	27·4	73	3·27	21	7·4
February	64·1	4	37·1	16	55·3	41·9	42·9	143·0	27·0	77	3·32	18	7·6
March	67·0	18	32·8	13	55·4	43·2	44·5	141·2	25·4	79	1·76	17	5·6
April	58·0	19	32·9	25	48·5	38·3	38·9	118·5	25·9	82	2·40	21	5·1
May	51·0	14	24·0	12	46·5	38·1	38·9	90·5	25·0	91	1·45	15	6·6
June	45·7	4	29·1	26	41·4	35·4	35·3	84·0	24·0	89	1·43	18	7·4
July	48·1	15	27·2	26	41·2	32·9	34·2	89·0	22·2	90	1·18	17	6·9
August	51·9	19	23·7	30	43·5	33·6	36·0	109·0	19·7	88	0·91	16	6·3
September ..	53·8	19	28·7	{2 23}	47·7	35·6	35·3	125·2	19·8	75	0 84	14	4·9
October ...	58·9	27	29·7	12	49·5	37·4	37·8	148·9	22·2	81	1·07	20	7·4
November ..	68·2	11	33·0	10	52·1	40·3	38·9	146·0	25·8	72	1·24	14	6·9
December	64·4	9	30·5	2	51·9	39·8	39·9	149·8	23·5	76	2·92	25	7·2
Means	..	..	..	..	49·0	38·3	38·7	124·6	24·0	81	(Sum) 21·79	(Sum) 216	6·6
Extremes	68·2	Nov. 11.	23·7	Aug. 30.	55·5	32·9	..	150·5	19·7	..	..	..	..

By Robert H. Scott, ...

Point King Lighthouse, King George's Sound, Western Australia.

Monthly averages of Barometrical Observations taken during the years 1862 to 1868. The results are obtained from 4 observations daily, viz., 9 a.m., Noon, 3 p.m., and 8 p.m. Observations corrected and reduced to 32° Fah. at mean sea level, and made with instruments verified at Kew.

Date.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
1862	29·985	29·965	30·060	30·137	29·980	29·795	29·881	30·107	29·887	29·987	29·936	29·978	29·975
1863	30·028	29·950	30·013	30·028	29·931	29·971	30·027	30·079	30·083	29·842	29·901	29·942	29·983
1864	29·936	30·021	30·106	30·001	30·191	30·156	29·957	29·980	29·952	30·056	30·014	30·040	30·034
1865	30·035	30·036	30·048	29·954	30·180	30·092	30·123	30·061	30·038	30·112	29·984	30·003	30·056
1866	30·036	29·938	30·094	30·114	30·055	30·062	30·021	30·153	30·017	29·911	30·047	29·977	30·035
1867	*29·999	29·940	30·100	30·088	30·024	29·907	29·956	30·086	29·809	29·847	30·072	30·014	29·987 (11 months only.)
1868	30·028	30·006	30·073	No obs.	30·117	29·824	30·104	30·146	29·912	30·017	30·095	30·029	30·032
Average for 7 years	30·007	29·979	30·071	(6 years only.) 30·054	30·068	29·972	30·010	30·087	29·957	29·967	30·007	29·998	30·015

* Observations missing for 28th January, 1867.

N.B.—The large difference between the results for the year 1868 cannot be satisfactorily accounted for; the difference is considerably lessened by throwing out the 4 a.m. and Midnight Observations at Breaksea Island (thus using similar hours for each station). During 1868 the readings for both hours seem almost invariably too low when compared with those for other hours; they may have been taken by another Observer.

CONTRIBUTIONS TO THE METEOROLOGY OF WEST AUSTRALIA.—*Continued.*

By Robert H. Scott, F.R.S.

Breaksea Island Lighthouse, King George's Sound, Western Australia.

Monthly Averages of Barometrical Observations taken during the years 1862 to 1868. The results are obtained from 6 observations daily, viz., 4 a.m., 9 a.m., Noon, 3 p.m., 8 p.m., and Midnight. Observations corrected and reduced to 32° Fah. at mean sea level, and made with instruments verified at Kew.

Date.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	September.	October.	Nov.	Dec.	Year.
	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
1862	29·998	29·955	30·065	30·142	29·981	*29·819	29·850	30·115	29·851 † 4 observations daily.	29·990 † 4 observations daily.	29·929	29·988	29·974
1863	30·028	29·948	29·997	30·016	29·917	29·949	30·009	30·061	30·084	29·841	29·896	29·962	29·976
1864	29·937	30·027	30·116	29·979	30·180	30·131	29·937	29·998	29·939	30·042	30·002	30·029	30·026
1865	30·038	30·034	30·051	29·951	30·170	30·096	30·110	30·043	30·027	30·108	29·976	30·003	30·051
1866	30·045	29·944	30·098	30·114	30·047	30·058	30·018	30·142	30·002	29·896	30·078	29·995	30·036
1867	30·020	29·946	30·099	30·088	30·017	29·894	29·951	30·060	29·797	29·822	30·030	29·983	29·976
1868	29·982	29·967	30·024	30·029	30·068	29·756	30·057	30·105	29·879	29·970	30·066	29·993	29·991
Average for 7 years	30·007	29·974	30·064	30·046	30·054	29·958	29 990	30·075	29·940	29·953	29·997	29·993	30·004

* [illegible]

APRIL 19th, 1876.

Ordinary Meeting.

HENRY STORKS EATON, M.A., President, in the Chair.

THOMAS HOPE GREEN BERREY, Assoc. Inst.C.E., New Town Hall, Manchester;
HARRY GEORGE BOLAM, Little Ingestre, Stafford;
JOHN BRAVENDER, F.G.S., The Firs, Cirencester;
JOHN HOLDEN, 64 Cross Street, Manchester;
GEORGE ALBERT HUTCHINS, M. Inst.C.E., 3 Guildhall Square, Carmarthen;
FREDERICK JACKSON, 18 Low Pavement, Nottingham;
THOMAS LOUIS JOHNSON, Assoc. Inst.C.E., Cardiff;
BALDWIN LATHAM, M.Inst.C.E., 7 Westminster Chambers, S.W.;
ALEXANDER GORDON MCBEATH, School Road, Sale, Cheshire;
WILLIAM ROBERT MAGUIRE, Marino Lodge, Killiney, Dublin;
ARTHUR SPENCE MOSS, 94 St. George's Street, E.;
CHARLES PINK, Winchester;
JOHN ROBERTS ROGERS, 4 Cuba Terrace, Hargrave Park Road, Upper Holloway, N.;
EBENEZER TOLLER, M.D., County Asylum, Wotton, Gloucestershire;
SAM TOMLINSON, Rose Cottage, Morton, near Bingley;
WILLIAM ANDREW MCINTOSH VALON, Gas Works, Ramsgate;
HERBERT WALKER, Public Offices, Basford; and
WILLIAM EDWARD WOOLLEY, Loughborough,
were balloted for and duly elected Fellows of the Society.
The names of Twelve Candidates for admission into the Society were read.

The following papers were then read:—

"Velocity of the Wind at Liverpool: Tabulation of Anemometric records." By W. W. RUNDELL, F.M.S. (p. 141.)

"On the Aspiration of the Dry and Wet Bulb Thermometers." By SAMUEL MILLER, F.R.A.S. (p. 150.)

"On the Storm which passed over the South of England on March 12th, 1876." By ROBERT H. SCOTT, F.R.S. (p. 159.)

The Meeting was then adjourned.

Donations received from April 1st to June 30th, 1876.

Presented by Societies, Institutions, &c.

Brussels	Académie Royale	Annuaires, 1875 and 1876.
	,, ...	Bulletins, Tomes XXXVII.-XL., 1874-1875.
	Observatoire Royal.....	Annales, March to May.
Copenhagen ..	Danske Meteorologiske Institut	Bulletin Météorologique du Nord, March 1st to May 31st. By Captain N. Hoffmeyer, Director.
Cracow	K. K. Sternwarte	Meteorologische Beobachtungen, March and April. By Dr. F. Karlinski, Director.
Dublin.....	Royal Dublin Society....	Journal, Nos. 1, 2, 6-40.
Fiume	I. R. Accademia di Marina	Meteorological Observations, February to April.
Hamburg	Deutsche Seewarte.....	Wetterbericht, January, February, April to June. By Dr. G. Neumayer, Director.
London	Army Medical Department	Report for the year 1874, Vol. XVI.
	General Register Office ..	Weekly Return of Births and Deaths, Nos. 13-19, 21-25.
	,, ,,	Quarterly Return of Marriages, Births and Deaths, March 31st. By the Registrar-General.
	London Institution	Journal, Nos. 27 and 28.
	Meteorological Office	Daily Weather Reports and Charts.
	,, ,,	Hourly Readings from the Self-Recording Instruments at the Seven Observatories in connection with the Meteorological Office, August to October, 1875.
	,, ,,	On the Physical Geography of the part of the Atlantic which lies between 20° N and 10° S, and extends from 10° to 40° W. By Captain Toynbee, F.R.A.S.
	,, ,,	Journal of the Royal Dublin Society, Nos. 41, 44.
	,, ,,	H. E. Hamberg. Om Nattfrosterna i Sverige, Aren 1871, 1872, 1873. By the Meteorological Committee.
	Royal Society	Proceedings, Vol. xxiv., Nos. 167-169.
	Science and Art Department	The Classed Catalogue of the Educational Division of the South Kensington Museum. Ninth Edition.
	War Office	Observations made at the Magnetical and Meteorological Observatory at the Cape of Good Hope, Vol. II. Meteorological Observations, 1841 to 1846.
Madrid	Observatorio	Anuario, 1871 and 1872.
	,, ...	Observaciones Meteorológicas efectuadas en el Observatorio de Madrid, December 1, 1868, to November 30, 1870.
	,, ...	Resúmen de las Observaciones Meteorológicas efectuadas en la Peninsula, December 1, 1868, to November 30, 1870. By A. Aguilar, Director.

Marlborough ..	Marlborough College Natural History Society .	Twenty-second Half-yearly Report, Christmas 1875. By the Rev. T. A. Preston, M.A., President.
Moncalieri	Osservatorio del R. Collegio Carlo Alberto	Bullettino Meteorologico, Vol. VII., Nos. 8 and 9, Vol. X., Nos. 2 and 3.
	„ „	Osservazioni Meteorologiche, Anno V., Nos. 9-18. By Padre F. Denza, Director.
Oxford.....	Radcliffe Observatory....	On the Rainfall for 25 years (1851-1875) as observed at the Radcliffe Observatory, Oxford. By the Rev. R. Main, F.R.S., Radcliffe Observer.
Paris.....	Observatoire de Montsouris	Bulletin Mensuel, Nos. 51-53. By M. H. Marié-Davy, Director.
	Observatoire National ..	Bulletin International. By M. U. J. Le Verrier, Director.
	Société Météorologique de France	Nouvelles Météorologiques, March to June.
Queensland ..	General Registry Office ..	Fifteenth Annual Report from the Registrar-General on Vital Statistics. By H. Jordan, Registrar-General.
Rome	Osservatorio del Collegio Romano.	Bullettino Meteorologico, March to May. By Padre A. Secchi, Director.
Sydney	Government Observatory	Meteorological Observations, October and November 1875. By H. C. Russell, B.A., F.R.A.S., Government Astronomer.
Toronto	Education Office	Journal of Education, March to May.
Upsala.....	Observatoire de l'Université	Bulletin Météorologique Mensuel, October to December, 1875. By Dr. H. H. Hildebrandsson, Director.
Utrecht	Koninklijk Nederlandsch Meteorologisch Instituut	Nederlandsch Meteorologisch Jaarboek voor 1871, Part ii. By Dr. C. H. D. Buys Ballot, Director.
Vienna	K. K. Centralanstalt für Meteorologie und Erdmagnetismus	Beobachtungen, February to April. By Dr. C. Jelinek, Director.
	Oesterreichische Gesellschaft für Meteorologie	Zeitschrift, Band XI., Nos. 7-12.
Washington ..	War Department.....	Daily Bulletin of the Signal Service, U.S. Army, with the Synopses, Probabilities and Facts, April and June, 1873.
	„ „	Monthly Weather Review, March and April. By Brigadier-Gen. A. J. Myer, Chief Signal Officer.
Watford	Natural History Society..	Transactions, Vol. I., Parts 3 and 4.
	„ „	List of Members, Laws and Catalogue of the Library, June 1876.

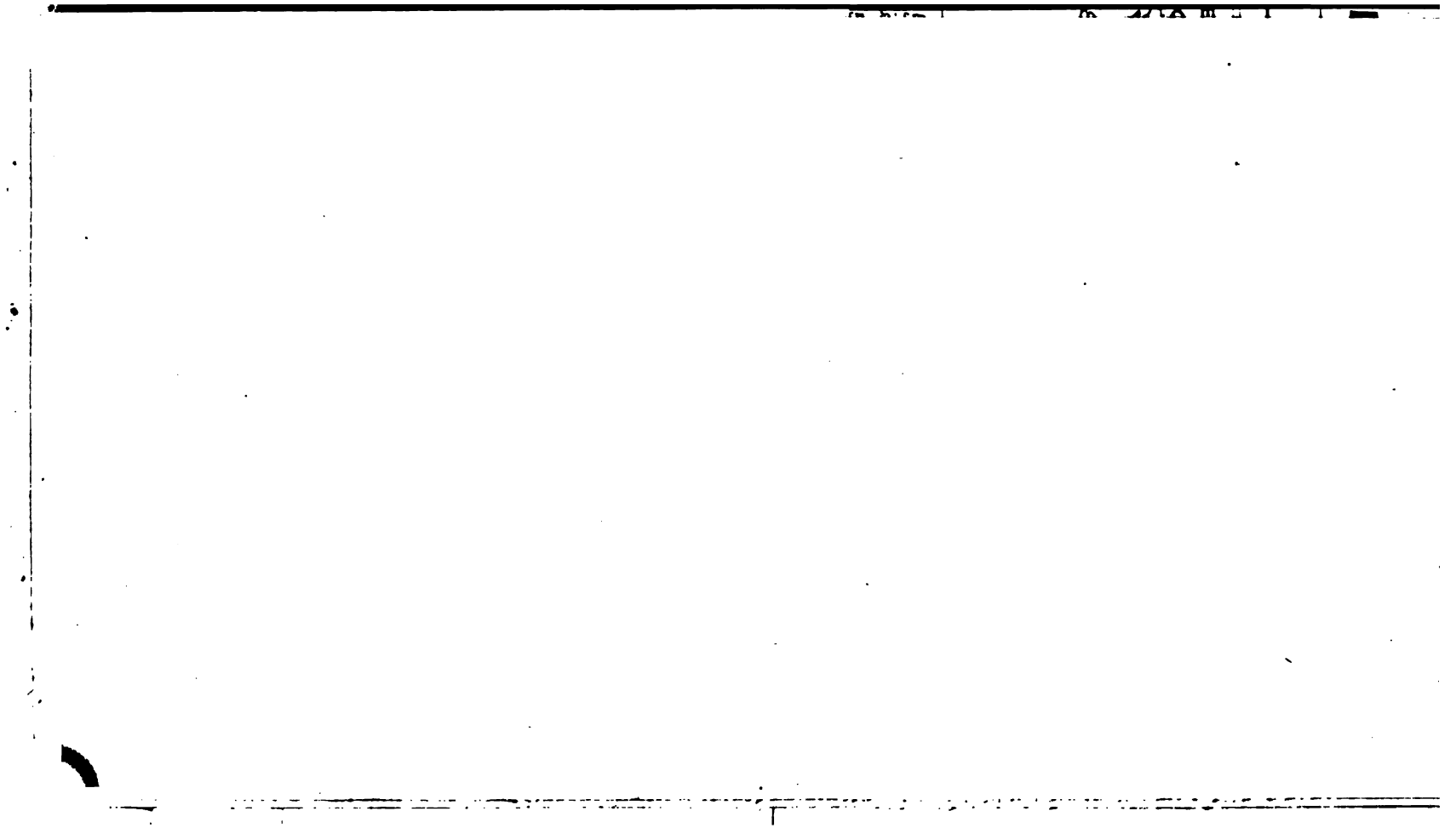
Presented by Individuals.

Aldridge, E. G.	The Climate of Eastern and South-Western England, Chapter IV. The Inferior Extremes of Temperature. By E. G. Aldridge. Letters to the 'Torquay Directory.'
„	The Temperature of Torquay; by E. G. Aldridge and E. Vivian. Letters to the 'Torquay Directory.'
Armit, Lieut. R. H.	Light as a Motive Power. By Lieut. R. H. Armit. 2 Vols.
„	The Science of Meteorology, Nos. 6, 7 and 8. Letters to the 'Hour.'
Armstrong, H. E.	Report of the Medical Officer of Health on the Sanitary Condition of Newcastle-upon-Tyne, with Tabular Returns and Diagrams of Mortality during the year 1875.

Blasius, Prof. W.	Storms: their Nature, Classification and Laws. With the means of predicting them by their embodiments, the Clouds. By William Blasius.
Blomefield, Rev. L., M.A.	Results of Meteorological Observations made at the Bath Royal Literary and Scientific Institution during ten years, commencing with March 1865, and ending with February 1875. By the Rev. Leonard Blomefield, M.A., President.
Brault, L.	Mémoire de Météorologie Nautique lu au Congrès International de Géographie; par L. Brault.
Clift, H. A.....	The Weather at Harbour Grace, Newfoundland, during March to May. (MS.)
Cotard, C.	Chemin de Fer Central-Asiatique. Communication faite à la Société de Géographie, 20 Décembre 1875, par C. Cotard.
Curtis, J.	Meteorological Memoranda for Manchester for the week ending April 6th.
Denning, W. F.....	Winter of 1875-6 at Bristol. By W. F. Denning.
,, ...	Radiant Points of Shooting Stars. By William F. Denning.
,, ...	Observed Courses of 71 Bright Shooting Stars seen at Bristol from November 1872 to March 1876. By William F. Denning.
Dunlop, W. H.	Results of Meteorological Observations made at Annanhill, Kilmarnock, Ayr, March and April.
Dyason, J. S.....	The Sailor's Horn Book for the Law of Storms. By Henry Piddington. Third Edition.
Forbes, A.	Meteorological Summary, Culloden, March to May. (MS.)
Galloway, W.....	On the Influence of Coal Dust in Colliery Explosions. By W. Galloway.
Graça, Fr. C. da	Mémoire sur l'origine et la cause de l'échauffement des eaux du Gulf-Stream, par Francisco Calheiros da Graça. Traduction par M. Désire Mouren.
Hankinson, R. C.....	Summary of Meteorological Observations taken at Red Lodge, Southampton, March to May. (MS.)
Higgs, Rev. W., LL.D. ..	The Telegraphic Journal and Electrical Review, Nos. 76-81.
Hinrichs, Dr. G.	Iowa Weather Review, Nos. 4 and 5, February and April.
Hopkinson, John, F.G.S...	Periodical Natural Phenomena. By J. Hopkinson.
,, ,, ..	Reports of the Field Meetings of the Watford Natural History Society in 1875. By J. Hopkinson.
,, ,, ..	The Rainfall in 1875 in the neighbourhood of Watford. By J. Hopkinson.
Hoskins, S. E., M.D , F.R.S.	Meteorological Observations taken at Guernsey, March to May.
Jelinek, Dr. C.	Ueber die Constanten der Aneroide und über Aneroide mit Höhenscalen. Von Dr. C. Jelinek.
Karlinski, Dr. F.	Ueber die periodischen Aenderungen der Lufttemperatur in Krakau, vom Prof. Karlinski.
Luvini, G.	Presentazione di un Modello di Dieterioscopio ad uso delle Scuole di Fisica e di Geodesia. Descrizione ed Applicazione del Medesimo. Third Communication by Giovanni Luvini.
,, ...	Le Diéthéroscope. Troisième communication par Prof. Jean Luvini.
McGregor, W.	Protection of Life and Property from Lightning during Thunderstorms. Written and compiled by W. McGregor. (Second Edition.)
Marchand, E.	Climatologie de la Ville de Fécamp ou Résumé Général des Observations Météorologiques faites en cette ville pendant les années 1863 à 1872, par Eugène Marchand.
,, ...	Etude sur la Force Chimique contenue dans la lumière du Soleil, la mesure de sa puissance et la détermination des climats qu'elle caractérise; par Eugène Marchand.
Miller, S. H., F.R.A.S. ..	The Fenland and Eastern Counties Meteorological Circular and Weather Report, April to June.
Quetelet, E.	La Tempête du 12 Mars, 1876; communication par M. Ern Quetelet.
Ragona, Prof. D.	Andamento Annuale della Temperatura. Memoria del Prof. Domenico Ragona.

Sainte-Claire-Deville, C...	Sur la périodicité des grands mouvements de l'atmosphère; par M. Ch. Sainte-Claire-Deville.
,, ..	Rapport sur le projet d'un observatoire au sommet du Pic du Midi du sommet de Bigorre, soumis à l'Académie par M. le général de Nansouty, au nom de la Société Ramond; par M. Ch. Sainte-Claire-Deville.
,, ..	Sur les methodes en Météorologie, par M. Ch. Sainte-Claire-Deville.
,, ..	Sur les variations ou inégalités périodiques de la temperature. Periode du vingtième jour dodécuple. Notes 10 et 11. Par M. Ch. Sainte-Claire-Deville.
Sawyer, F. E.....	The Meteorology of Sussex. By F. E. Sawyer.
Schück, Capt. A.	Verzeichniss der Vorlesungen, welche am Hamburgischen Akademischen und Real-Gymnasium von Ostern 1876 bis Ostern 1877 gehalten werden sollen. Herausgegeben von Dr. G. M. Redslob.
,, ...	Die Fluss- und Bodenwässer Hamburgs. Chemische Beiträge zur Analyse gewöhnlicher Lauf- Nütz- und Trinkwässer sowie zu der Frage der Wasserversorgung grosser Städte von sanitärem und gewerblichem Standpunkte. Von Dr. F. Wibel.
Silver, S. W.....	The Colonies, Nos. 208-215.
Symons, G. J.	Symons's British Rainfall, 1875.
,, ...	Symons's Monthly Meteorological Magazine, April to June.
,, ...	Abstract of Meteorological Observations taken by the Rev. A. Beverly, LL.D., at the Grammar School, Aberdeen, during 1867.
,, ...	Brighton Rainfall. By F. E. Sawyer.
,, ...	Effects of the Drought of 1870 on some of the Experimental Crops at Rothamsted. By J. B. Lawes, F.R.S., and J. H. Gilbert, Ph. D., F.R.S.
,, ...	Meteorological Observations made at the Observatory of Hamburg, January 1853 to October 1856. By M. Rümker.
,, ...	Monthly Statement of Rain in the year 1874 at the Stations on the Manchester, Sheffield and Lincolnshire Railway.
,, ...	On the Rainfall of Barbados. By Governor R. W. Rawson.
,, ...	Outline Lunar Map, with Catalogue of 99 Objects; the whole deduced from Photograms, Observations and Measurement. By W. R. Birt, F.R.A.S.
,, ...	Sea-Air and Heart Disease. By Alfred Haviland.
,, ...	Summary of Rain and Melted Snow for the Summer and Autumn quarters of 1871, from Observations at 74 Stations in Canada, compiled at the Magnetic Observatory, Toronto.
,, ...	Temperature at Ventnor, Helston and Greenwich. Annual Maxima and Minima, 1848-72. By F. G. Aldridge.
,, ...	The Rainfall of 1873 in the County of Hereford. By the Rev. Nash Stephenson.
,, ...	Whirlwinds and Dust-Storms of India. An Investigation into the Law of Wind and Revolving Storms at Sea. By P. F. H. Baddeley. Plates.
The Editor.....	'Nature,' Nos. 336-348.
,, ...	'The Academy,' Nos. 204-216.
,, ...	'The Medical Press and Circular,' No. 1950.
,, ...	'The Sanitary Record,' Nos. 92-104.
Todd, C., F.R.A.S.	Observatory and Climate of South Australia. By Charles Todd, C.M.G.
Tripe, J. W., M.D.	Summary of Meteorological Observations made at Goole during 1875.
Tupman, Cap. G.L., F.R.A.S.	On the Great Meteors of 1875; September 3rd, September 7th and September 14th. By Capt. G. L. Tupman, R.M.A.
Walker, C. V., F.R.S. ..	Inaugural Address delivered by Charles V. Walker, F.R.S., President, in 1876, to the Society of Telegraph Engineers.
Ward, Col. M. F., F.R.A.S.	Recherches faites dans le but de déterminer la température de l'air par la marche d'un thermomètre non equilibré. Nouveau théorème d'algèbre sur ce sujet par Prof. C. Dufour.

Ward, Col. M. F., F.R.A.S.	Resumé des Observations Météorologiques faites à M par MM. Burnier, C. Dufour, et Yersin pendant les a 1850 à 1854. Par Prof. C. Dufour.
,, ,,	Sur la Température de quelques sources, par Prof. C. D
,, ,,	Le Golfe de Naples et ses Volcans et les Volcans en gé par H. Lebert.
,, ,,	Recherches sur la Condensation de la Vapeur Aque l'air au contact de la glace et sur l'Evaporation, par C. Dufour et T. A. Forel.
Watson, W. H., F.C.S. ..	Meteorological Memoranda, 1875, for Braystones, Whitehaven. (MS.)
,, ,, ..	Meteorological Summaries for the years 1874 and Braystones, near Whitehaven.
Whitmore, J., M.D.	Monthly Report on the Health and Meteorology Parish of Saint Marylebone, during January to Ma J. Whitmore, M.D.
Zenger, Prof. K. W.	Ueber ein neues Universalmikroskop und ueber ein photographisches Verfahren zur korrekten und beli Vergrösserung photographischer. Aufnahmen von Zenger.
,, ...	Ueber katadioptrische Fernröhre und Aplanaten, vo K. W. Zenger.
,, ...	Ueber dialytische Refractoren. Von Prof. K. W. Ze
,, ...	Ueber die Grundursachen der Sonnenfleckenperiod Prof. K. W. Zenger.



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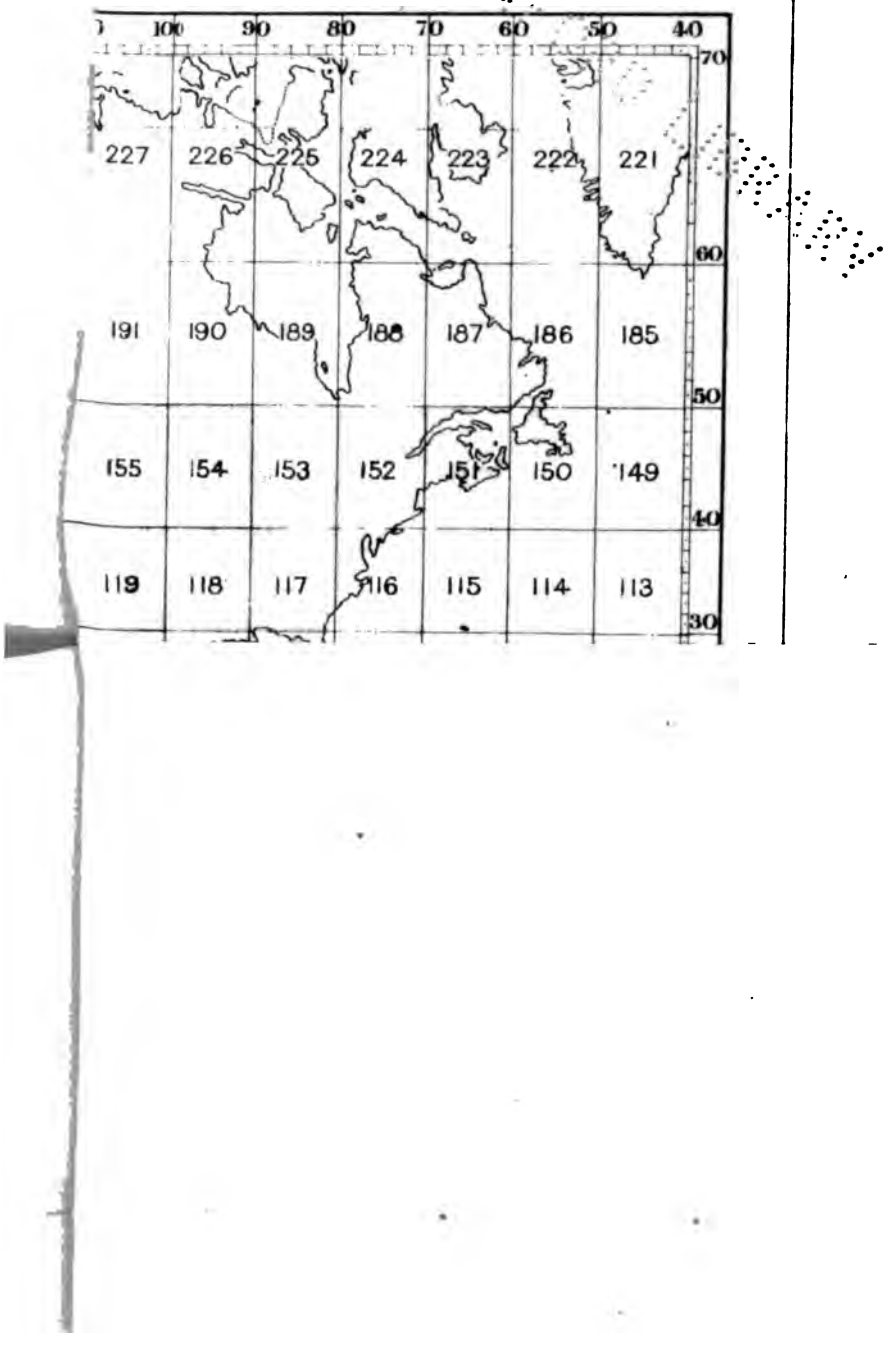


QUARTERLY JOURNAL

OF

THE METEOROLOGICAL SOCIETY.

VOL. III. No. 20.

XVI. *Remarks on the Present Condition of Maritime Meteorology.* By ROBERT H. SCOTT, F.R.S., Director of the Meteorological Office.

[Received March 13th.—Read May 17th, 1876.]

THE Brussels Conference in 1853 was organised through diplomatic channels, and was attended by representatives from the following nations:—

Belgium,	Norway,
Denmark,	Portugal,
France,	Russia,
Great Britain,	Sweden,
The Netherlands,	The United States.

The most important portions of the Report of the Conference, as regards the future prosecution of Maritime Meteorology, were, in addition to the recommendations relating to the improvement of instruments, the following paragraphs:

"The object of the Conference being to secure, as far as possible, uniformity of record, and such a disposition of the observations that they would admit of ready comparison, the annexed form of register was concerted and agreed upon. The first columns of this form will receive the data which the Government of the United States requires merchant vessels to supply, in order to entitle them to the privileges of co-operators in the system of research, and may therefore be considered as the minimum of what is expected of them. This condition, which it may be as well to state here, requires that at least the position of the vessel and the set of the current, the height of the barometer, the temperature of the air and water should each be determined once a day, the force and direction of the wind three times a day, and the observed variation of the needle occasionally.

"Every abstract log kept by a merchant vessel should contain at least what is here recommended. Anything more would enhance its value, and make it more acceptable.

"The remaining columns are intended principally for men-of-war to fill up, *in addition* to those above mentioned, but it is believed that there are many officers in the mercantile navy also who are competent to this undertaking, and who will, it is hoped, be found willing to distinguish themselves in this joint action for the mutual benefit of the services.

"In the compilation of this form, the Conference has had carefully in view the customs of the service, and the additional amount of attention which these duties will require, and it is believed that the labour necessary for the purpose, at least to the extent specified in the instructions for filling up the columns, is only such as can be well performed under ordinary circumstances, and it has considered it a minimum, and looks with confidence to occasional enlarged contributions from zealous and intelligent labourers in the great cause of science.

* * * * * *

"The Conference, having brought to a close its labours, with respect to the facts to be collected and the means to be employed for that purpose, has now only to express a hope that whatever observations may be made, will be turned to useful account when received, and not be suffered to lie dormant for the want of a department to discuss them; and that should any Government, from its limited means, or from the paucity of the observations transmitted, not feel itself justified in providing for their separate discussion, it is hoped that it will transfer the documents or copies of them to some neighbouring power, which may be more abundantly provided and willing to receive them.

* * * * * *

"The Conference has avoided the expression of any opinion as to the places or countries in which it would be desirable to establish offices for the discussion of the logs, but it is confidently hoped that whatever may be done in this respect, there will always be a full and free interchange of materials, and a frequent and friendly intercourse between the departments; for it is evident that much of the success of the plan proposed will depend upon this interchange, and upon the frankness of the officers, who in the several countries may conduct these establishments."

The only nations which have systematically pursued the study of the subject since November 1858, have been the United States, Holland, and this country.

As regards the United States, abstract logs, kept by captains of any nationality, were for some years received at the Naval Observatory, Washington, and several captains regularly sent the materials collected in their ships to Washington for discussion. The operations of the Naval Observatory in this department were, however, suspended at the time of the war, Commander Maury having left the Observatory in April 1861. An elaborate report on the publications issued under his superintendence, such as the

"Wind and Current Charts" and the "Sailing Directions," was afterwards drawn up, at the request of the United States Government, by a Committee of the National Academy of Science, and published in their Report for 1864. The first of the resolutions contained in that Report was to the effect that the publications in question "ought no longer to be issued in their present form."

Operations of the same nature as those conducted by Maury have not since been resumed at the Naval Observatory, and the subject of Maritime Meteorology has been transferred thence to the Hydrographic Office.

When, in 1874, Commodore Wyman, the Hydrographer, was invited to the Maritime Conference in London, he declined to attend, but furnished detailed remarks on various points which had been submitted to him, which are printed in the Report of that Conference, and of which the following are the most important, as bearing on the present position of Maritime Meteorology in the United States.

"The Abstract Logs were printed and issued both to naval and merchant vessels, but are not now issued to either. The log now in use in the navy of the United States is substantially the same, as far as its Meteorological Records are concerned, as the log recommended at Brussels; we employ the Howard Cloud nomenclature and a scale for wind forces differing not materially from the Beaufort scale.

"The United States Hydrographic Office (in its Meteorological Department) under the Bureau of Navigation, will be always ready to consider any general suggestions as to the most profitable mode of discussion of observations, but while it regards with much interest the proceedings of the various Meteorological Conferences, and the growing popularity and importance of the science of Meteorology, it is not prepared to enter into any arrangement for a division of labour as regards subjects of inquiry.

"The Journal issued is for the collection of data for a specific purpose, the revision of our present Wind and Current Charts, this being the only subject of inquiry in this science in which it is at present engaged."

Holland was the first country to follow the example of the United States, the Royal Meteorological Institute of the Netherlands having been founded January 1, 1859, mainly by the exertions of Professor Buys Ballot and Captain Jansen. As concerns the position taken up by the Institute in question in regard of the action of the Brussels Conference, Professor Buys Ballot's reply to the circular convening the Maritime Conference of London, also printed in the above-mentioned Report, affords precise information. He quotes from two pamphlets issued by him in 1872 and 1878 respectively:—

"I have from the beginning thoroughly opposed the Resolutions of the Brussels Conference. I was, however, bound to observe those regulations because of the American publications which were carried on in accordance with them. But as soon as the Dutch Institute had its own publications, I adopted another form of log.

"The Brussels Conference asked for too many observations, *e.g.* psychrometer, specific gravity, &c. which we could not expect to be made accurately

by merchant ships, and which are of no use to them. Moreover, the hours 8 and 9 were not convenient. The true course and distance, which are of practical use for Sailors and Directors of Institutes, were not required.

"I beg to refer you, for further particulars, to the following extracts from my printed papers:—

"'1 'Suggestions on a Uniform System of Meteorological Observations.'

"'The Congress held at Brussels aimed at accomplishing too much, and thence many were discouraged.

"'Or how else shall we account for it, that especially in the Netherlands, which soon declined to observe these directions, most observations have been sent in.

"'In all probability it would have been sufficient to confine the observations to the end of the watch kept on board a ship, and not to ask for too much information. If I may be allowed to state what has in this country attracted most attention, and with respect to which we have been supplied with the most and the best observations, it will be this:—

"'1. We require at the beginning of the log book a statement of the corrections of the instruments after they have been examined by persons appointed for that purpose by the Central Observatory.

"'2. The number of days the ship was at sea.

"'3. The conjectured and observed position of the ship.

"'4. The heights of the barometer by the mercurial barometer.

"'5. The direction and force of the wind.

"'6. The temperature of the surface of the sea.

"'No one will deny to these observations their high practical and theoretical value.

"'7. Deviations of the compass.

"'On entering a port, or whenever there is an opportunity at sea to veer the ship, the deviations are verified. The safety of the ship depends too much on the local deviations that time may well be sacrificed.

"'8. The temperature observations, if there be any place on board fit for taking them.

"'Psychrometrical observations; how much rain fell in one day; deep sea soundings, &c., may be safely left to the interest of captains themselves and to such opportunities as are afforded.

"'What is of most importance to navigation must have the greatest weight with us.'"

"'2. 'A Sequel to the Suggestions on a Uniform System of Meteorological Observations.'

"'I do not see any safer means of knowing the average indications of the instruments, for every time of the year and every place, than to note in our registers every observation on a different page, according to the place in the ocean, and separately for every day of the year, that we may be able to make

a graphic table of these observations, and to see if any districts of the sea have some phenomena in common, and what are the boundaries of these districts.

"'Unhappily it is not sufficient to form squares of five degrees *à priori*, for it will often be the case that one half of such a square shows a digression from the mean opposite to that of the other half. For instance, if we seek the limits of the Trade Winds, shall we find them by studying only large squares, viz. from 15° to 20° lat., and from 20° to 25° long., &c.? Are they at the same latitude in different longitudes? It is impossible to determine them if we do not know what passes at every square degree, at every square minute of a degree. Sooner or later, therefore, some one will come to the system of giving separately what has been observed at separate points of space and time.'"

Professor Buys Ballot's views on co-operation in the subject of Maritime Meteorology are expressed in his "Sequel," above noticed, at pp. 48-49, in the following words:—

"The material of the observation is not so well provided that, if distributed over three or four Institutes, each, England, France, Germany, even England, to which the lion part belongs, would have a sufficient number of them, in a certain part of the ocean, to be able to derive therefrom the details, and to be certain that these details are not only apparently true. So it might be that another nation had published charts of the same region which gave, or appeared to give, different details, no more true and exact than the other, from the same cause, want of sufficient information.

"Now we must conclude that even this nonconformity in some points shows us the uncertainty of these points, but it would have been better to join the two sets of observations, and to derive from the whole number a more reliable result. Were the two charts precisely after the same model, every one could combine them afterwards; but such is not always the case, and not always reciprocally. England can make use of the Dutch charts, and Mr. Scott has trusted so much the Dutch sailors that he has done them the honour of inserting their detailed observations into his charts. Would it not have been preferable and less expensive, if one of us had the whole material and had given only one chart?

"So our chart of icebergs is, considering the time when it was given out, a good chart, but we are the first to complain of the scantiness of observations recorded. Therefore, when one Institute declares that it will study the physiognomy of a district in a given direction, we earnestly implore all other Institutes to supply it with all possible information they possess, gratuitously, as we are willing to do."

It will be seen, therefore, that Holland, while it has declined to be bound by the letter of the Brussels Resolutions, has fully complied with their spirit, and the publications of the Utrecht Establishment have been both numerous and important, but they have hitherto referred, almost exclusively, to the districts traversed by the Dutch vessels on their passages to and from the Indian Archipelago.

Very recently the Dutch Institute has undertaken the investigation of the China Seas, and has issued an invitation to Germany and to this country to supply it with the information in their respective offices for the region in question, on the the terms defined by Professor Buys Ballot in the extracts above quoted, viz. that it was prepared to supply them, in return, with the materials in its possession for any investigation they might wish to undertake, the expense of copying the information being borne by the respective donors, not by the recipients.

The history of Maritime Meteorology in this country need hardly be traced in this paper, having been given at considerable length in evidence before various Commissions and Committees of Inquiry in 1866, 1873, and 1876.

The publications on the subject which at first emanated from the Meteorological Department of the Board of Trade, were reproductions of some of Maury's charts, in a graphical form. These reproductions were not of his "Track Charts," as has frequently been supposed, but of his "Pilot Charts." The difference between these two classes of charts is that in the Track Charts the observations of each element, over the area of the chart, for the different months, were printed *in the actual spots where they were taken*, and the months were distinguished by differences of colour, &c. &c.; while in the Pilot Charts the winds were given for five-degree squares *numerically* in roses. These latter data were represented by Admiral FitzRoy also in roses, but *graphically*. These were the Board of Trade Wind Charts, and were issued for the entire ocean. Data from Maury's Track Charts were used for currents, but not for any other investigations.

As soon as he had accumulated materials out of the Board of Trade logs, Admiral FitzRoy began to combine their information with that contained in Maury's publications, and published charts for the North Atlantic Ocean for five-degree squares, for the four months, February, May, August, and November, containing information on winds (direction and force), currents, sea, temperature, prevalence of rain, and magnetic variation and dip. The force of the wind in these charts was taken exclusively from Board of Trade logs, as Maury's charts gave no statistics on that head. It had been apparently Admiral FitzRoy's intention to have issued these charts for each month, if the publication had been approved by the public, but his death in 1865 checked all operations in this direction.

The Meteorological Committee of the Royal Society have undertaken the minute investigation of limited portions of the ocean, and have endeavoured to extract from the logs in their Office all the information which they contain, on all the phenomena observed, in pursuance of the resolutions of the Brussels Conference.

It will be easily seen when we have found that for an area of the ocean comprising, in round numbers, say 50 degrees of longitude and 30 degrees of latitude (fifteen ten-degree squares) 31 per cent. of the entire data are collected into the space of a single ten-degree square, that any attempt to draw conclusions applicable to the whole region would be perfectly mis-

leading, as the preponderance of materials from the central square would necessarily influence the means for any parallels of latitude or meridians passing through that area.

The foregoing remarks embrace the general features of the work carried on as a direct outcome of the Brussels Conference, up to the year 1872.

In addition, however, to what has been mentioned, several publications of high value have appeared in various quarters since 1853, which may be considered as more or less direct evidence of the interest for Maritime Meteorology which was evinced at Brussels.

In the first place, Lieut. Fergusson published in 1856, under the auspices of the East India Company, three series of monthly wind and current charts for the Indian Ocean and China Seas, the Persian Gulf, and the Red Sea and the Gulf of Aden.

The Hydrographic Office of the Admiralty published in 1868 its "Pilot Charts for the Atlantic Ocean," and in 1872 its "Wind and Current Charts for the Pacific, Atlantic and Indian Oceans," which, as appears on the face of the charts, were compiled from the various published charts and works on Meteorology in all languages and from documents in the Hydrographic Office. These charts are for three-monthly periods, and refer in the first instance to wind—giving direction only, with the proportion of calms—and in the Pilot Charts, of gales also. Currents are given in two separate charts each for the whole year, the areas corresponding to the areas of the respective wind charts. As regards the barometer and thermometer, the pilot charts contain mean monthly values for a few land stations, but without any intimation of the authorities whence the original information has been derived. In the wind and current charts we find isobaric and isothermal charts for the globe, of the same type as those of Buchan and Dove respectively. The text of the charts contains also additional information on various Meteorological subjects.

In France, monthly wind charts were published in 1861 by Vice-Admiral Vicomte de Chabannes for the East Coast of South America, and in 1864 by Lieut. Le Helloco for the South Pacific Ocean. In addition, M. Charles Ploix published in 1868 a volume entitled "Vents et Courants, Routes Générales," which was extracted from Maury's Sailing Directions and the most recent publications. In 1874 this work was re-issued, having been corrected in accordance with information subsequently rendered available.

In Hamburg, Herr von Freeden succeeded in organising an Office for Maritime Meteorology in 1867, under the municipal authorities of that town, entitled the Nord-Deutsche Seewarte, and he devoted his energies to the production of wind charts for the North Atlantic, and to the preparation of sailing directions for individual voyages. In 1875 these operations were interrupted by the transference of the office to the German Government, and it has since been re-organised on a very extensive scale, Dr. G. Neumayer being placed at its head.

The only other operations in the direction of Marine Meteorology prior to 1872 which merit much notice, have been mainly with reference to the South

Indian Ocean; Mr. Meldrum, of the Mauritius, having published in 1856 a paper on the Meteorology of the Indian Ocean for the month of March, 1853, and several papers on individual storms; and Dr. G. Neumayer, when at the Flagstaff Observatory, Melbourne, having discussed ships' logs for the routes between Europe and Australia and given the results in two volumes published by him, principally in that entitled "Meteorological and Nautical Observations," 1858-1862.

At the same time a new line of treatment of observations taken at sea came into the foreground—that of employing them for the investigation of weather in addition to their use in climatological inquiries.

The first suggestion of this work with which I am acquainted, is to be found in a paper by Professor Buys Ballot in "Poggendorff's Annalen Ergänzungs Band," Vol. IV., 1854, and Admiral FitzRoy, in Appendix H. to his first Report for 1857, distinctly requested captains of ships to furnish such simultaneous observations over a definite area of the North Atlantic.

In 1861, however, the idea took a definite shape in the way of international co-operation, M. Le Verrier making a proposal that the globe should be divided for the purposes of weather study, France to take the Atlantic, England to take the Indian Ocean, while Russia and the United States should take Asia, the Pacific Ocean, and America.

The outcome of this proposal has been that for nine months of 1864, and for the whole of 1865, a series of daily synoptic charts were published by M. Le Verrier, entitled "Atlas des Mouvements Généraux de l'Atmosphère," which embraced the North Atlantic north of 40° N., and Mr. Meldrum commenced the preparation of daily synoptic charts for the Southern Indian Ocean for the year 1861.

This proposal of Le Verrier's has been comparatively fruitless, because the only region for which there was a reasonable probability of material sufficient for the construction of satisfactory charts being procurable was the Atlantic, so that there was no prospect of France being able to furnish to other nations, for the Indian or Pacific Oceans, an amount of material at all commensurate either in quantity or quality with what she requested those nations to furnish her for her investigations.

At the present time the value of synchronous observations over the entire globe has been taken up energetically by the United States Signal Office, under Brigadier-General Myer, commencing with the year 1874, and furthermore Captain Hoffmeyer has undertaken to re-produce in his daily Synoptic Charts from Europe and the North Atlantic, for the year 1875, any observations made at sea which may be supplied to him.

This is then the present state of the question of simultaneous observations at sea, and it is obvious that if they are to be carried out, observations must be continued over all parts of the sea embraced by the charts, no matter what material may have been accumulated for the climatological investigation of the district, or how well the means of each element may have been determined for it.

To return to the climatological branch of the subject, and its development

ce 1872. In that year, at the preliminary Meteorological Conference at ipzig, the question of Maritime Meteorology, which had not originally)eared on the programme for discusssion, was, on the proposal of Dr. umayer entertained, and certain resolutions were adopted, relating for the st part to the desirability of introducing uniformity of methods, &c. the st important of which was the fourth.

" With reference to the utilisation of the results, the Conference would ge the importance of uniformity in the methods employed. In close ation therewith is the carrying out of the division of labour of the central tions of the individual states. This principle must be recognised as of the atest importance for the further development of Maritime Meteorology. e repetition of work over definite regions, with reference to the area to be estigated, must be declared as indefensible in the interests of this de-opment."

In 1873 at Vienna, the subject was again discussed, the Leipzig Resolu-ns were re-adopted, and it was further recommended that offices for aritime Meteorology should be organised in each country, and that a special aritime Conference should be held for the discussion of the entire question Ocean Meteorology. It was subsequently decided that the Conference)uld be of a private character, and that it should be held in London.

As one of those who voted for a Private Conference, I may be allowed to r that as I found that the delegates to the Official Conference at Brussels tinctly declined to pledge their respective Governments to any course of ion in the following words, which appear in their Report:—

" Before entering upon any discussion, it was the desire of all the members the Conference that it should be clearly understood that, in taking part in) proceedings of the meeting, they did not in any degree consider them-ves as committing their respective Governments to any particular course action, having no authority whatever to pledge their country in any way these proceedings,"

I did not see any utility in attempting to give the meeting an official aracter, which would at once have raised delay, if not difficulties, in e way of convening it, and which character would probably, as *e.g.* at ussels, be disowned for it by some, if not all, of those present. More-er, I thought that it would do more harm than good to the science, if the solutions of an Official Conference were to be treated as a dead letter, as s practically been the case in more than one quarter with regard to e Brussels Conference.

The Meeting was ultimately held in London in August 1874, and was tended by gentlemen from every maritime country in Europe except reece; in addition India and China were represented. The United States id Sweden took part in the Conference by correspondence.

The general result of the Conference was to approve the action taken at russels, with certain slight alterations and improvements, to express a more r less decided approval of the methods followed in the Meteorological ffice as regards instructions to observers and the treatment of observations,

and with reference to the ultimate character of the work, to adopt the following resolutions :—

"*Discussion.*—It is desirable that every Institution should publish the observations and results in such a manner that every foreign Institute can incorporate them with its own observations and results in the easiest way possible; that is, by preserving the number of observations, together with any means derived from them, for single square degrees.

"It is further desirable that, whatever Charts be published, the results for single square degrees should be published in a tabular form.

"It seems desirable for the use of the Sailor that each Chart should have reference to only one element, or, at least, only to elements closely related to each other.

"*Subjects of Inquiry.*—The division of labour, as regards investigations, can only be carried out by mutual agreement between the several Institutions; and each Institution shall announce to other Institutions what investigations it proposes to undertake.

"It is very desirable that such division of labour should be effected.

"*Sailing Directions.*—The sailor wants the result of experience alone, and he must receive assurance that his observations have been turned to use. When these results of experience have been given, the theorist may point out the reason why certain routes are the best."

Let us now see what has been the progress of the subject since 1874, if indeed we may not claim for this progress that it has been the direct outcome of the Meeting to which reference has just been made.

In the first instance, the German Government, as already stated, has taken the Deutsche Seewarte under its own direct control, and has furnished it with funds on a most liberal scale. This action took definite effect in the course of the year 1875.

At the close of the same year the French Ministère de la Marine organised an office at the Depôt des Cartes et Plans, under the superintendence of M. Charles Ploix, whose name has been before mentioned.

Meanwhile Holland and this country have continued on their previous course.

The India Office has of late applied to the Meteorological Office for a copy of all the information in its possession for the Indian Seas north of the Equator.

As regards special publications, the only recent Charts which appear to merit particular notice have been those of M. Brault, a lieutenant in the French Navy, which have been laid before the recent Geographical Conference in Paris. They are Wind Charts for the North Atlantic for three-monthly periods, and indicate both the direction and force of the wind.

As regards any action in the way of international co-operation in investigations, the fact of the Dutch and German Institutes having undertaken to investigate the China Seas (0°-30° N. lat. and 100°-150° E. long.), and the Atlantic (30°-50° N. lat. and from coast to coast in longitude) respectively, should be mentioned. These Offices have agreed to interchange the information in their respective possessions for these districts.

The Meteorological Office has undertaken the district embracing the South Point of Africa (30°-50° S. lat. and 10°-40° E. long.).

The Committee have not been able to promise to supply the information in their Office unless the recipients would bear the costs of correcting the observations and extracting them into data books, which would, at the lowest estimate, amount to £8 per 1,000 sets of observations, so that, for the area already dealt with of 30 degrees of latitude and 30 degrees of longitude, which yielded 112,995 sets of observations, the costs of the mere preparation of the information for discussion, with the experience of such work now gained in the Office, would not fall short of £900. It can hardly be doubted that the information requested by the German Institution would be to the full as costly, so that unless funds were placed at the disposal of the Committee, for the special purpose of supplying information to foreign Institutions, it would not be possible for them to enter into any arrangement of the nature of that proposed. At the same time the Committee have signified their entire readiness to place all the materials in the Office at the service of foreign Institutions, if the latter will only bear the costs of extraction of the data.

It will be interesting to conclude these remarks with an account of what is actually being effected in the way of determining the Meteorological conditions of the entire ocean.

As is well known, the surface of the globe, between 80° N. and 70° S., is divided into 540 squares of ten degrees of latitude and longitude each. If we mark on a chart (Plate VII.) all the squares in higher latitudes than 60° N. and S., and all the squares which are occupied entirely or nearly so by land, there remain about 300 which may be termed ocean squares. In the Report of the Committee of Inquiry (1866), this number was estimated at 330, and it was stated at p. 11:—

"We think we may be justified in provisionally assuming that 100 observations in each month in every five-degree square, or 5,000 observations altogether in every one of the 330 ten-degree squares, would represent the average number with which the department would have to deal before its work is complete."

And at p. 40:—

"We make the following estimate:—

"Ocean statistics,

"Issue of instruments and registers annually	£1,500
"Discussion and publication of results	1,700
Total ...	£3,200

"This expenditure ought to terminate in about 15 years, as by that time a sufficient number of observations to determine the Meteorological means will have been collected and discussed."

If we leave alone, for the sake of argument, the degrees of accuracy for the respective means, which are laid down as requisite in the Report in question, it will be easy to see what has been effected since 1866 in this country, and what, as far we know, is being done elsewhere.

On Plate VII. the usual tracts from Europe to the principal foreign ports have been laid down from Berghaus's Chart of the World. Allowing a certain margin on each side of these tracts, we shall find that about 100 of these 800 ocean squares are not, under ordinary circumstances, traversed by any ships, so that the idea of being ever able, by the ordinary course of trade voyages, to amass 5,000 observations in *any*, not to say in *every one*, of the squares in question appears to me visionary. Ocean Meteorology, when we come to minute work, is and must remain of a "patch-work" character.

Plate VIII. gives a fair idea of what the condition of the information for the Pacific in the Meteorological Office was in 1866. Admiral FitzRoy had commenced to attack that great *mare incognitum*, as regards its meteorology, and the chart represents the quantity of information which was extracted by him. It does not in any way show the amount of material for each month, or whether or not this was sufficient to give its means with any approach to accuracy. It merely indicates that observations for so many months existed; but there may have been only three or four sets of observations in each month.

The Office has already published the results of this work for the region about Cape Horn, and is publishing a portion for the China Seas, as an appendix to the forthcoming paper, by Staff-Commander Tizard, of H.M.S. "Challenger," on the Meteorology of Japan.

Practically, therefore, the entire area of the Pacific, except the China Seas, the homeward route from Australia to Cape Horn, and the district immediately about Cape Horn, is a blank, as regards observations pretending to accuracy existing in the Meteorological Office, and I strongly suspect the case is the same in other offices. Of course this chart takes no cognisance of any observations made on land in our own colonies or elsewhere; but, as regards the Central Pacific, I am not aware of a single station on any of the islands where regular observations of any value have ever been taken for any considerable length of time, say even five or six years. On this point I would refer to the letter from the Rev. S. J. Whitmee in "Nature," vol. xi. p. 405, and to subsequent correspondence I have had with that gentleman. It is perfectly impossible to exercise sufficient control over isolated observers at such a distance without some local arrangements for regular inspection.

This chart has not undergone very material alterations since 1866.

If we now turn again to Plate VII., and look at the regions which are, at the present moment, either investigated or in process of investigation, in what I would venture to term the requisite detail—*i.e.* with a degree of accuracy infinitely more minute than was contemplated in the Report of the Committee of Inquiry (1866), and probably involving the publication of means for *single degree squares* – we find that we have already finished, and are publishing, nine squares in the Atlantic, and are undertaking six squares off the South Point of Africa; the Dutch are undertaking 15 squares in the China Seas, and the Germans 18 squares in the North Atlantic. It may, perhaps, be permitted to express a regret that the limits of latitude of the last-mentioned investigation do not descend to 20° N., so as to join on to the region investigated in the Meteorological Office.

The India Office has also commenced, at Mr. Blanford's request, to obtain for him from the Meteorological Office materials for discussion of the Northern Indian Ocean, embracing 15 squares. This region joins on to that undertaken by the Dutch, so that we may say that the entire district between the coast of Asia and the Equator, and for 110 degrees of longitude, is being dealt with.

It will accordingly be noticed that the North Atlantic between 20° and 80° N., and between 50° and 60° N., the entire South Atlantic from 10° S., the South Indian Ocean and the whole extent of the Pacific, except the China Seas, are regions as yet absolutely untouched, excepting in such a general way as has been effected in the earlier charts, Wind Charts, &c., before mentioned.

If we therefore consider what may be termed the "unsurveyed world," to apply to Ocean Meteorology the term used by Staff-Commander Hull in a paper read before the Royal United Service Institution in 1875, we must admit that at least three-fourths of the surface of the ocean are likely to be in this unsatisfactory condition for several years to come.

It is not too much to say that we cannot pretend that a sufficient knowledge of the conditions of the lower strata of the atmosphere over the sea has been attained until *at the very least* monthly charts for all the elements for five-degree squares over the whole navigable globe shall have been published. When these are complete the requirements of scientific men, both seamen and landsmen, will demand far more minute work for any regions which will afford sufficient material to repay discussion.

The resolution of the London Conference should again be repeated if any one should be found to maintain that general charts, for three months at a time, meet the wants of the public:—

"It is desirable that, whatever charts be published, the results for single-degree squares should be published in a tabular form."

DISCUSSION.

Dr. NEUMAYER said that the Deutsche Seewarte had been organised in its Meteorological Department in strict accordance with the principles laid down by the Congress of Vienna and the Maritime Conference of London; one of these principles was the division of labour, which had been carried out in so far as an agreement with the Meteorological Institute of Utrecht had been arrived at, according to which the Seewarte should undertake the discussion and publication of the North Atlantic from 30° to 50° N. With regard to the remark made by Mr. Scott, that such an arrangement, if adhered to, would leave a blank of 10° latitude, he would only say, that he would be very happy to assist the Meteorological Office in any investigation, and should, therefore, cause the preliminary adopted plan to be altered in so far as the Seewarte would undertake the discussion of the space under consideration.

Captain HULL remarked that the labour of compiling the Admiralty Wind Charts was considerably lightened by the observations being in many cases already reduced by Maury, FitzRoy and others; the £1,000 referred to by Mr. Scott having been spent upon the observations to considerable advantage. The closing remarks of the paper express the general wants of sailors with regard to Ocean Meteorology, viz. "monthly charts for all the elements for five-degree squares over the whole navigable globe." In some parts of the Ocean, such as the regions in which the Trade Winds meet, closer investigation is however desirable; here the results for one-degree squares require to be tabulated, as lumping the

winds in five-degree squares at certain seasons is liable to produce chaotic results. The present three-monthly charts do not give the requisite information with regard to the change of seasons; for instance, in the Indian Ocean, the observations for October being mingled with those for November and December, somewhat damaged the wind chart for that quarter of the year. In Admiral FitzRoy's Wind Charts a No. in the left hand corner of the square indicated the number of observations that had been used in constructing the wind star: he (Captain Hull) regretted this system had not been followed in the construction of the present wind charts, as by that means the amount of confidence that might be placed upon the diagrams would be seen at a glance, and also information would be given as to where more observations were required; in fine, they would be in some degree similar to the shaded charts drawn to accompany Mr. Scott's paper. In his paper on the Unsurveyed World, he had attempted to show how large a portion of the world was still unsurveyed, and Mr. Scott had certainly by his paper and accompanying charts proved that a very considerable portion of the globe was also (if he might be allowed to coin a word) un-meteorologised.

Captain TOYNBEE was glad to learn from Dr. Neumayer that Germany was willing to extend its North Atlantic work down to 20° instead of 30° N. latitude. His experience of the Meteorological Office showed that sufficient data had not yet been collected for the construction of one-degree charts for any part of the Ocean. He had, however, been convinced of the importance of dealing with the actual observations of winds, currents, &c. instead of basing arguments on the passages made by ships of various sailing qualities, by seeing the different conclusions at which the various countries arrived, which used the latter method, as to the best routes for crossing the Equator in the various months. Still all praise was due to the men who, like Dr. Neumayer, had made such very able use of the small amount of data at their command.

Dr. NEUMAYER wished to state, with reference to the remarks made by Captain Toynbee, that he had not recommended vessels to pass to the East of the Cape Verd Islands, on their way to the Line, all the year round, but merely during the summer months, June, July and August. He might perhaps be allowed further to remark, that the methods adopted by the Deutsche Seewarte in extracting ships' logs and classifying the results, have been shaped according to those in practice by English authorities, which have proved to be at the same time simple and practical.

XVII. *On the Mean Temperature of Every Day, from all the Thermometrical Observations taken at the Royal Observatory, Greenwich, from the year* 1814 *to the end of* 1873. By JAMES GLAISHER, F.R.S.

[Received March 29th.—Read May 17th, 1876.]

IN the year 1857, I communicated to the Society a paper entitled "On the determination of the Mean Temperature of every day in the year, from all the Thermometrical Observations taken at the Royal Observatory, Greenwich, from the year 1814 to the end of 1856," which is printed in the Annual Report of the Council for that year (p. 56). I have there given the mean temperature of every day in the year, derived from a complete reduction of all the thermometrical observations made at the Royal Observatory, between January 1st, 1814, and December 31st, 1856. When the half century of observations was completed, I reduced additional seven years' readings in the same manner, and thus obtained the mean daily temperature of every day in the year, each result being thus based upon fifty observations. This paper was read before the Society on February 15, 1865, and is printed in the "Proceedings," vol. ii. (p. 327). I now have the honour to lay before the Society

ıe results for the ten years 1864 to 1878, and the daily means given by the xty years' observations.

I have previously remarked that the results for the seven years ending 868 were of a different character to those at the beginning of the series, nd it will be seen that this change of climate is confirmed still more decidedly y the contents of the present paper.

In my two previous communications I have fully explained the nature of ıe observations, and the manner in which they have been treated, so that it ı only necessary to state here, that those for the decade 1864 to 1878 belong ɔ the series which was commenced in 1848, and which has been continued ince without change, viz. they consist of observations of the dry bulb hermometer, four feet above the soil, taken daily at the hours of 9 a.m., ıoon, 8 p.m., and 9 p.m., together with the maximum and minimum emperatures of each day.

To the means of the observations at 9 a.m., noon, 8 p.m., and 9 p.m., orrections were applied daily for diurnal range, by the application of ıuantities taken from my Tables of Diurnal Range, as dependent upon the ange of temperature in the day (Fourth Edition, London, 1867).

The corrections which have been applied subtractively to the arithmetical nean of the daily maximum and minimum temperatures are extracted from he same Tables.

The second column of Tables I. to XII. shows the mean temperature of very day from the observations of 50 years; the 10 succeeding columns give he successive mean temperature of the same day in the years 1864 to 1878, nd the 18th column gives the mean values as found from 60 years' observations.

In the 14th and 15th columns are shown the lowest mean temperature on that day that has occurred in the 60 years, and the year of its occurrence; in the 16th and 17th columns the highest mean temperature and the year of occurrence; while the last column contains the extreme difference of mean temperature of the same day which has taken place in 60 years, the numbers being derived from the 14th and 16th columns by simple subtraction.

In the notes at the foot of each month, the extremes of daily mean temperature in the month are noted.

From the numbers in Table XIII., by comparing each consecutive pair together, it would seem that the addition of 10 years' observations has not greatly lessened the number of instances of large differences between the mean temperature of consecutive days, and by comparing the numbers of such cases in this table with those in the table based on 48 years' observations, it appears that for the most part where large differences then existed they still appear; and it is probable that some of these sudden changes represent physical facts, and are not due to "runs of luck."

Table XIV. is formed by taking the differences of temperature between consecutive days, the sign (+) indicating that the temperature of the following day was higher than that of the preceding; and the sign (—), that it was of lower temperature.

TABLE I.—JANUARY.

Mean Temperature and Extremes of Mean Temperature for every day in the month of January.

Days of the Month.	Mean of Temperature of 50 years.	Mean Daily Temperature of the Air.										Mean of Temperature of 60 years.	Lowest and Highest Mean Daily Temperature in 60 years.				Difference between the coldest and hottest day.
		1864	1865	1866	1867	1868	1869	1870	1871	1872	1873		Lowest.	Year.	Highest.	Year.	
	°	°	°	°	°	°	°	°	°	°	°	°	°		°		°
1	37·8	32·9	31·7	39·5	26·5	28·9	36·1	45·4	24·6	39·2	45·3	37·3	19·9	1820	52·2	1860	32·3
2	36·4	29·8	28·9	43·7	23·9	29·8	43·2	46·0	24·8	43·2	43·5	36·3	22·1	1836	49·9	1851	27·8
3	36·2	28·7	32·8	43·9	22·1	27·1	46·0	46·5	30·1	41·2	45·0	36·2	22·1	1827-67	49·8	1860	27·7
4	36·8	27·8	41·8	46·4	13·2	27·9	43·2	47·1	29·3	44·7	47·8	36·8	13·2	1867	48·9	1817	35·7
5	35·9	26·6	43·9	44·7	23·3	30·8	47·2	43·0	32·7	44·5	44·5	36·3	22·6	1820	50·6	1844	28·0
6	36·2	21·1	39·5	36·7	37·8	32·1	42·7	42·7	37·3	41·2	48·5	36·5	21·1	1864	48·5	1873	27·4
7	35·8	22·6	38·2	40·9	49·2	28·7	43·9	45·4	38·6	40·4	46·5	36·4	17·4	1841	49·2	1867	31·8
8	35·2	27·3	41·7	41·9	45·6	31·5	49·3	45·6	35·4	35·8	47·5	36·0	12·8	1841	49·3	1869	36·5
9	35·4	32·4	43·2	35·3	43·2	29·7	47·9	42·5	33·0	36·7	48·8	36·0	20·9	1838-41	49·7	1862	28·8
10	36·0	40·1	47·7	38·2	39·3	30·3	41·4	34·3	31·9	35·5	49·7	36·5	19·6	1814	49·7	1873	30·1
11	36·1	39·5	44·2	32·1	32·4	31·0	37·9	34·4	31·9	44·5	49·8	36·4	21·0	1838	49·8	1873	28·8
12	36·4	37·2	43·3	30·9	27·5	38·4	39·3	37·1	28·8	41·3	45·8	36·5	16·8	1838	50·7	1818	33·9
13	36·9	36·9	37·9	39·1	24·0	45·2	37·1	37·0	30·0	47·7	49·2	37·2	18·7	1820	49·3	1849	30·6
14	36·1	36·2	41·7	50·2	19·3	46·9	37·4	45·1	40·3	39·9	48·7	36·9	16·2	1815	50·2	1866	34·0
15	35·1	32·5	39·7	45·7	25·9	44·9	45·9	44·8	37·5	35·1	45·8	35·9	14·6	1820	50·7	1818	36·1
16	36·0	35·0	38·0	46·4	30·6	44·8	44·1	44·6	39·8	35·4	48·1	36·8	18·9	1826	49·4	1818	30·5
17	36·6	36·8	34·0	45·7	27·7	48·5	45·7	41·7	36·7	42·1	43·1	37·2	22·3	1830	50·3	1849	28·0
18	36·9	41·3	33·9	47·1	27·6	45·5	40·2	36·0	39·4	42·6	42·0	37·3	18·1	1830	51·1	1828	33·0
19	37·0	44·4	35·0	46·9	26·9	43·6	36·1	34·3	34·6	39·9	42·0	37·2	13·4	1823	49·9	1849	36·5
20	36·7	45·2	33·1	46·6	28·5	36·7	35·5	31·1	35·6	39·0	35·2	36·7	10·7	1838	49·6	1853	38·9
21	36·8	45·3	24·7	48·5	28·1	36·7	35·0	31·5	36·0	37·8	35·1	36·6	22·2	1814	48·9	1840	26·7
22	37·8	49·9	28·4	49·0	24·1	37·3	33·6	33·2	37·9	40·2	39·6	37·7	22·6	1820	51·4	1846	28·8
23	37·6	48·5	31·9	44·5	44·1	33·7	29·8	36·4	36·4	43·4	37·9	37·8	21·1	1829	51·8	1834	30·7
24	38·1	39·1	33·6	38·8	49·5	33·0	30·0	35·7	33·3	44·0	39·1	38·0	20·9	1815	52·7	1834	31·8
25	38·2	39·1	32·7	40·1	43·9	40·9	34·7	32·1	29·9	44·5	33·2	38·0	22·8	1829	51·4	1824	28·6
26	38·8	40·4	33·4	40·7	42·0	37·5	40·0	28·9	29·3	43·3	36·9	38·5	25·1	1848	51·0	1834	25·9
27	38·7	47·0	32·4	40·3	51·5	37·8	40·7	26·9	29·7	41·1	33·7	38·6	26·5	1848	51·5	1867	25·0
28	38·0	44·5	29·5	44·5	47·6	46·7	47·6	29·6	30·4	40·0	32·1	38·2	21·0	1848	52·3	1843	31·3
29	38·3	34·2	31·3	42·9	45·8	38·9	46·2	31·8	33·4	43·6	33·1	38·3	26·2	1857	49·6	1843	23·4
30	38·5	32·8	36·1	41·4	46·8	41·9	45·8	36·5	30·7	46·4	33·5	38·6	23·6	1816	49·3	1854	25·7
31	38·1	35·9	40·3	47·2	41·3	47·8	52·0	40·7	30·8	46·2	34·2	38·7	20·0	1830	52·1	1862	32·1
Means	36·9	36·5	36·3	42·6	34·2	37·2	41·1	38·3	33·2	41·3	42·1	37·1	..	..	..	..	..

The mean temperature of the coldest day in January in sixty years was 10°·7, on the 20th day in the year 1838.

The mean temperature of the hottest day in January in sixty years was 52°·7, on the 24th day in the year 1834.

The difference between these numbers is 42°·0, and it represents the extreme difference between the mean temperature of two days in the month of January in sixty years.

The day of the month whose mean temperature has been subjected to the greatest difference, 38°·9, was the 20th; and that to the least, 23°·4, was the 29th.

TABLE II.—FEBRUARY.

Mean Temperature and Extremes of Mean Temperature for every day in the month of February.

Days of the Month.	Mean of Temperature of 50 years.	Mean Daily Temperature of the Air.										Mean of Temperature of 60 years.	Lowest and Highest Mean Daily Temperature in 60 years.				Difference between the coldest and hottest day.
		1864	1865	1866	1867	1868	1869	1870	1871	1872	1873		Lowest.	Year.	Highest.	Year.	
	°	°	°	°	°	°	°	°	°	°	°	°	°		°		°
1	37·2	39·2	43·9	50 8	46·1	48·0	49·4	42·0	32 7	46 3	29·3	38·1	22·0	1830	51·5	1852	29·5
2	37·3	44·8	46 8	46 3	43·1	43·3	41·5	43·1	34 6	46·0	29·0	38·1	17·0	1830	52·2	1850	35·2
3	37·4	45·4	42 7	42 7	39·7	40·4	47·2	44·6	38·5	42·0	32·2	38·1	19·2	1830-41	50 3	1862	31·1
4	38·0	35·5	33·7	44·1	43·3	40·3	51·6	44 8	43 8	43·5	34·7	38 6	22·0	1814	51 6	1869	29·6
5	39·1	32·7	34 5	44·1	42·2	44·3	52·1	42·6	47 4	45 5	31·6	39·5	19 0	1830	52·1	1869	33·1
6	39·1	31·5	37·7	50·6	43·1	40·9	50·3	42·9	46·4	48·7	31·8	39·7	18 7	1830	51·1	1854	32·4
7	39·8	28·4	45·1	47·5	39·7	41·1	50·0	41 6	43·8	46·8	36·3	40·2	22·2	1841	50·0	1869	27 8
8	39 4	30·5	36·6	42·4	48·5	38·0	50·8	39·2	47 0	46·1	34 6	39·7	19 7	1816	50·8	1869	31·1
9	38·7	28·3	34·2	46·8	47·1	34·5	47 2	28·4	42·2	45·9	33·7	38·7	12·6	1816	55·0	1831	42·4
10	38·4	30 3	32·5	45·4	48 6	44·5	50·4	25·9	37·7	49·9	35·0	38·7	22·6	1816	51·7	1831	29·1
11	38·1	33·5	26·8	42 8	42·3	43 5	50 6	24 7	26·5	47·2	33 2	37 9	24·5	1845	50 6	1869	26·1
12	37·9	42·7	30·1	39 0	47·7	37·0	43·1	23 9	35·3	44 2	36 6	37 9	19·2	1845	49·1	1842	29·9
13	37·6	48·5	26·0	35·4	46·1	42 4	40 1	26 8	41·5	45·9	37·5	37 8	24·8	1847	48·5	1864	23·7
14	37 9	44·(	28·2	38·1	43·6	44·0	45·9	29 5	41·7	44 8	37·9	38 2	24·5	1855	50·3	1848	25·8
15	38·6	46·0	24·0	38·2	47·5	40·5	46 7	32 3	42·9	42 2	38 4	38·8	24·0	1865	53·0	1850	29·0
16	38·6	43 2	32·3	42·5	51·4	38·2	48·2	32·9	43·5	38·3	36 6	39 0	24·5	1855	51·4	1867	26·9
17	37·7	37·5	33·7	36·3	48·0	41·3	48·6	29 9	45·9	44·2	34·1	38·1	21·8	1855	51·1	1852	29·3
18	38 6	33·8	38·9	30·6	41 9	42 0	44·1	29·4	48 3	46·3	33·6	38·7	21·1	1855	49·3	1847	28·2
19	38·8	28·9	37·1	32·7	46 5	42 9	42·3	34·3	48 0	46 0	32·1	38·9	23·3	1855	49·6	1862	26·3
20	38·2	26·9	32·3	34·6	48 6	40·5	42·8	36 6	44 0	44·4	31·1	38 2	25·8	1855	50·0	1862	24·2
21	39·2	29 6	32·0	36·7	47·5	47 7	39 9	35 5	42·3	42·3	29·3	39·1	24·8	1855	48·9	1815	24·1
22	39·8	31·5	38 1	36·8	47·4	44 3	33 5	30·1	40·6	43·4	36 8	39·5	26·8	1855	50·7	1849	23·9
23	39·9	30·5	45 6	42·8	45·3	39·1	37·0	36 2	46·1	43 9	33·5	39·9	26 1	1814	51·8	1846	25·7
24	29·1	32·2	42·1	39·4	46 1	48·0	41·5	42·0	43·0	48·2	27 6	39·4	25·5	1814	53·4	1846	27·9
25	39·8	34·7	41·0	41 7	44·3	51·4	41·5	36 3	42·5	47 7	36·6	40·1	24·1	1814	51 4	1868	27·3
26	39·4	35·5	40·6	39 6	39 9	48·5	47·4	41·9	44·9	43·1	45 6	40·0	26 5	1814	50·7	1828	24·2
27	39·5	36 8	42·4	34·3	37·4	46 5	45·2	45·9	51·0	39·2	37·4	39·9	25·6	1821	52·1	1846	26 5
28	39·6	42·3	45·8	31·5	37·4	48·7	39·5	50 3	45·1	39·0	34·2	39·9	29·2	1820	52·4	1846	23·2
29	..	40·0	..	..	..	45·9	..	..	..	47·0	..	..	..	..	..	..	..
Means	38·7	36·0	36·6	40·5	44·7	43·0	45·3	36·2	42·4	44·8	34·3	39·0	..	..	..	..	..

The mean temperature of the coldest day in February in sixty years was 12°·6, on the 9th day 1 the year 1816.

The mean temperature of the hottest day in February in sixty years was 55°·0, on the 9th ay in the year 1831.

The difference between these numbers is 42°·4, and it represents the extreme difference be- reen the mean temperature of two days in the month of February in sixty years.

The day of the month whose mean temperature has been subjected to the greatest difference, °·4, was the 9th; and that to the least, 23°·2, was the 28th.

TABLE III.—MARCH.

Mean Temperature and Extremes of Mean Temperature for every day in the month of March.

Days of the Month.	Mean of Temperature of 50 years.	Mean Daily Temperature of the Air.										Mean of Temperature of 60 years.	Lowest and Highest Mean Daily Temperature in 60 years.				Difference between the coldest and hottest day.
		1864	1865	1866	1867	1868	1869	1870	1871	1872	1873		Lowest.	Year.	Highest.	Year.	
	°	°	°	°	°	°	°	°	°	°	°	°	°		°		°
1	39·8	40·1	43·9	28·3	34·7	40·1	40·9	50·9	37·3	52 1	36·8	39·9	28·3	1866	52·1	1872	23·8
2	40·6	36·7	42·3	33·6	33·5	47·4	39·5	53·0	43 2	51·2	40·8	40·9	29·4	1858	53 0	1870	23·6
3	41·1	38·0	39·7	31·9	35·4	48 0	35·0	48 4	46 7	50 2	41·7	41·2	29·6	1858	51·2	1842	21·6
4	40 2	47·7	39·7	33 8	38·2	50·0	36 9	34·9	51·8	47 9	50·1	40·7	27·2	1845	54·8	1859	27·6
5	39·3	41·5	39·1	36·0	38·9	48·3	43·7	37·5	49·5	50 3	43·8	39·9	26·3	1845	52·0	1859	26·7
6	40·2	45·1	36·6	37·0	33·7	43 3	38·0	36·0	50·9	49·9	40 9	40·4	24·5	1845	50·9	1871	26·4
7	40 1	46·1	36·9	36·0	33·2	43·9	35·8	36·8	45·2	48·7	43·1	40·2	26·5	1839	51·9	1862	25·4
8	40·0	41·7	35·9	37·7	32·9	39·5	35·3	38·6	43·8	49·8	43·0	40·0	28·5	1814-39	53·3	1862	24 8
9	40·0	33·8	37 6	39·6	34·8	40 8	37 3	41·5	41·8	43·9	45·6	40 0	27·8	1839	56·3	1826	28 5
10	39·7	37·0	36·2	37·7	40·4	43·9	35·0	41·2	44 2	38·1	39·1	39·6	23·9	1820	54·1	1826	30·2
11	40·3	44 8	38·5	40·1	36·2	43·8	34·7	40·7	48 9	42·1	39 6	40·6	27·8	1847	51·6	1830	23·8
12	41·3	42·3	36·9	41·0	33 4	47 0	36 8	33·9	49·9	44 2	39·0	41·2	30·6	1845	53·5	1859	22·9
13	42·0	44·8	37·3	36·3	30·3	49·8	34·5	33·5	44·8	45·1	35·3	41·5	22·1	1845	52·2	1859	30·1
14	42·0	49·5	36·3	32·1	31·8	47·8	33·9	33·9	43·1	45·2	34·5	41·5	23·2	1845	52·8	1828	29·6
15	41·6	45·4	35·2	36·3	34·1	42·6	35·1	38·5	34·3	47·5	37·3	41·1	26 8	1845	52·9	1822	26·1
16	42·5	40·2	36·4	44·9	32·2	45·4	34·3	48·9	35·7	49 7	38·0	42·2	25·2	1845	54·3	1828	29·1
17	41·8	39·7	37·3	44·3	32·1	43·7	36·5	51·7	38 2	51·3	40·7	41·8	28·5	1845	51·9	1822	23·4
18	41·5	38·4	34·6	43·7	29·7	42·2	39·7	44·0	45·8	45·6	40·6	41·3	28 5	1853	53·2	1857	24·7
19	42·1	43·2	35·1	42·6	33·8	41·9	43 0	36·2	45 2	41·0	38·2	41 8	28·5	1814	54 6	1822	26·1
20	42·8	44·5	30·2	40·1	34·6	41·4	35·6	38·8	45 6	37 6	39·5	42·1	30·2	1865	58 0	1836	27·8
21	41·9	40·0	31·6	34·6	34 1	50 5	39·2	46·8	42·1	30·3	36·8	41·4	27·2	1837	52·1	1843	24·9
22	42·1	40·5	35·5	35·2	36·9	48·3	39 6	40·9	40·2	33 5	39·9	41·6	29 6	1817	54·2	1852	24·6
23	42·1	40·1	35·9	40·7	47 6	39·2	36 6	33·7	49·5	33·1	41·8	41·7	32·2	1837	53·3	1852	21·1
24	42·2	39·0	34·2	44·5	51 4	37·5	37·8	36·9	53·3	33·8	46·7	42·1	29·0	1837	54·8	1858	25·8
25	41·3	39 5	35·7	47·2	48 8	38·8	42·4	35·9	53 9	35·1	45·7	41·5	32·2	1837-53	53 9	1871	21·7
26	42·2	38·9	34·3	45·2	49·9	43·8	40·7	34·0	55·3	35·2	44·1	42 2	31·2	1850	56·3	1830	25·1
27	43·4	38·1	32·9	52·0	46 8	48 0	34·5	37·1	44·6	43 6	45·2	43·2	31·2	1837	54·1	1830	22·9
28	44·1	41·1	35·0	50 0	42·9	43·3	35·9	34·9	37·9	51·0	45·6	43·7	34·5	1850	56·2	1822	21·7
29	43·9	39·2	33·1	52·9	43·0	39·9	36 2	35·8	39 1	52·9	47·9	43·6	33·1	1865	53·8	1830	20·7
30	44·3	38·2	36·0	54·4	43·1	39·9	37·7	36·3	43·1	52·8	50·9	44·1	35·3	1859	54·4	1866	19·1
31	43 9	44·3	44·3	46 7	41·5	44·4	41·1	37·1	46·3	50·1	47·8	44·0	31·8	1824	58·6	1815	26·8
Means	41·6	41·3	36·6	40 5	37·7	44·0	37·5	39·6	44·9	44·6	41·9	41·5	..	..	..	..	..

The mean temperature of the coldest day in March in sixty years was 22°·1, on the 13th day in the year 1845.

The mean temperature of the hottest day in March in sixty years was 58°·6, on the 31st day in the year 1815.

The difference between these two numbers is 36°·5, and it represents the extreme difference between the mean temperature of two days in the month of March in sixty years.

The day of the month whose mean temperature has been subjected to the greatest difference, 30°·2, was the 10th; and that to the least, 19°·1, was the 30th.

TABLE IV.—APRIL.

lean Temperature and Extremes of Mean Temperature for every day in the month of April.

Days of the Month.	Mean of Temperature of 50 years.	Mean Daily Temperature of the Air.										Mean of Temperature of 60 years.	Lowest and Highest Mean Daily Temperature in 60 years.				Difference between the coldest and hottest day.
		1864	1865	1866	1867	1868	1869	1870	1871	1872	1873		Lowest.	Year.	Highest.	Year.	
	°	°	°	°	°	°	°	°	°	°	°	°	°		°		°
1	43·7	43·8	47·6	43·0	44·9	47·0	39·4	37·9	40·4	50·2	49·3	43 8	27·8	1836	57·0	1848	29·2
2	44 2	42·1	43·2	40 8	52·8	46·8	41·4	41·1	44·6	45·0	49·0	44·3	32·4	1839	61·8	1848	29·4
3	44 7	44·1	44·0	41·8	50·4	47·6	41·0	41·4	45·6	41·4	47·1	44·7	28·9	1839	60·7	1848	31·8
4	44·8	53·3	44·8	39·0	50·5	50·5	39·9	38·0	43·9	40 4	48·5	44·8	29·5	1839	61·3	1848	31·8
5	45·3	36·8	50 8	42·3	49·5	51·4	44·6	43·0	45·6	43·3	47·3	45·3	29·7	1839	55·6	1859	25·9
6	46·0	41·2	52·2	46·3	50·9	52·3	46·0	46 7	39·2	42·2	41·6	46 0	34·0	1839	61·1	1859	27·1
7	46·1	43·6	52·8	43·8	50·0	53·1	52·8	50·6	40·2	45·9	41·0	46·3	34·0	1837	63·0	1859	29 0
8	45·8	44·4	54·7	45·2	47·1	42·6	51·1	51·9	42·5	52·0	42·7	46·1	34·4	1839	56·2	1821	21·8
9	44·5	47·9	56·4	42·4	47·7	39·6	44·3	46·9	43·0	48·4	40·7	44·7	31·7	1837	56 4	1865	24·7
10	44 9	51·1	56·9	45·7	46·4	40·6	51·2	47·1	41·1	51·1	41·9	45·3	30·4	1837	56·9	1865	26·5
11	44·2	53·1	52·1	48·2	44·6	40·0	58·8	47·7	44·1	53·8	41·3	44·9	31·7	1837	58·8	1869	27·1
12	44·9	48·1	50·5	50·8	45·1	37·3	61·8	47·9	54·7	57·5	42 6	45·7	33·9	1817	61·8	1869	27 9
13	44·5	44·3	53 8	52·3	45·9	41·6	59·2	51·5	53·8	51·4	42·0	45·4	31·4	1837	59·2	1869	27·8
14	45·8	46 2	50·1	49·9	47·7	45·9	62·0	54·0	50·8	48·0	50·0	46 6	31·5	1816	62·0	1869	30·5
15	46 3	52·8	46·8	50·8	48·8	46·8	52·6	52·2	50·5	54·5	59·0	47·2	36·5	1816	59·0	1873	22·5
16	46·3	46·9	52·1	48·8	47·5	52·3	46·9	50·4	50·7	49·7	57·9	47·0	33·5	1835	60·1	1858	26 6
17	45·7	48·9	59·9	51·1	51·2	50·8	45·3	49·9	51·4	45·8	54·8	46·6	33·1	1837	59·9	1865	26·8
18	46·0	51·1	57·9	51·4	54·8	45·2	45·2	47·1	50·0	43·2	51·5	46·6	33·0	1838	57·9	1865	24·9
19	46·2	55·9	53·3	52·4	56 9	48·1	44·4	55·3	50·3	42·0	49·3	47 0	32·4	1849	58·2	1854	25·8
20	47·5	60·2	52·3	49·4	49·6	48·7	48·9	63·1	45·8	40·5	50·4	48·1	33·9	1838	63·1	1870	29·2
21	47·5	54·6	57·5	51·8	42·8	53·2	52·4	60·5	49·7	43·6	49·8	48·2	36 8	1849	60·5	1870	23·7
22	47·9	51·1	58·8	47·9	49·2	54·0	52·9	55·3	51·8	47·2	43·4	48·5	38·0	1837-60	58·8	1865	20·8
23	47 8	51·5	56·4	46 0	55·7	49·6	54·2	53·8	51·2	48·6	40·8	48·3	36·4	1827	58·5	1821	22·1
24	47·3	44·8	53·3	48·5	53·7	50·0	54·3	51·2	45·0	49·4	37·0	47·5	36 6	1860	59·5	1821	22·9
25	47·3	48·0	50·5	52·9	45·6	47·5	54·4	55·4	48·9	51·6	37·5	47·6	37·5	1873	63·2	1821	25·7
26	48·0	48·0	57·0	55 0	45·2	52·2	51·3	49·8	52·6	53·0	38·6	48·4	37·0	1857	63·2	1821	26·2
27	47·1	48·8	61 5	63·0	48·5	50·1	56·5	45·5	51·4	57·6	40·8	48·0	36·2	1861	63·5	1841	27·3
28	48·0	44·4	55·8	55·2	48·6	46·2	58·2	40·7	52·0	50·1	46·0	48·3	39·4	1838	61·0	1840	21·6
29	48·7	49·5	44·6	41·1	49·1	55·3	49·1	43·6	53·9	50·0	45·4	48·6	35·4	1836	61·7	1840	26·3
30	49·3	49 7	42·4	40·8	49·2	56·2	48·6	47·8	47 6	52·7	48·7	49·2	38·4	1836	61·4	1830	23·0
ans	46·2	48·2	52·3	47·9	49·0	48·1	50·3	48·9	47·7	48·3	45·9	46·6	..	..	..	..	..

The mean temperature of the coldest day in April in sixty years was 27°·8, on the 1st day in year 1836.

The mean temperature of the hottest day in April in sixty years was 63°·5, on the 27th day in year 1841.

The difference between these numbers is 35°·7, and it represents the extreme difference between the mean temperature of two days in the month of April in sixty years.

The days of the month whose mean temperature has been subjected to the greatest difference, ·8, were the 3rd and 4th; and that to the least, 20°·8, was the 22nd.

TABLE V.—MAY.

Mean Temperature and Extremes of Mean Temperature for every day in the month o

Days of the Month.	Mean of Temperature of 50 years.	Mean Daily Temperature of the Air.										Mean of Temperature of 60 years.	Lowest and Highes Mean Daily Temperat in 60 years.			
		1864	1865	1866	1867	1868	1869	1870	1871	1872	1873		Lowest.	Year.	Highest.	Yea
	°	°	°	°	°	°	°	°	°	°	°	°	°		°	
1	50·1	53·0	46·9	39·7	49·7	55·5	45·1	48·6	47·4	53·2	56·4	50·0	40·4	1856	62·8	182
2	51·1	55·7	56·0	40 6	50·9	55·5	48·5	42·0	48·0	54·8	53·3	51·0	40·3	1856	59·8	183
3	50·5	51·6	59·1	42·9	56·3	63·4	51·3	40·2	52·3	54·8	48·7	50 8	36·2	1832	63 4	186
4	51 2	46·5	55·7	44 9	56·8	51·2	42·5	44·1	46·1	52·8	45·1	50 8	40·2	1851	66 3	183
5	51·5	49·1	61 0	47·2	57·2	48·2	48·2	48·1	50·0	51·9	46·3	51·4	40·6	1856	62·7	186
6	51 6	55·4	57·9	50·0	66·9	46·2	53·8	48·7	56·5	47·5	48·2	51 9	39·7	1831	66·9	186
7	51·9	53·3	50·9	53·4	68·7	49·5	57·2	47·6	49·7	48·6	47·7	52 0	38·0	1853	68·7	186
8	51·6	47·0	53·0	53·6	64·2	56·3	52·2	43·6	54·7	45·8	48·7	51 7	40·1	1853	64·2	186
9	50 8	45·4	57·1	53·3	62·7	58·6	49·7	44·7	46·5	47·3	50·7	50 9	38·2	1837	63·2	183
10	50·8	51·2	47·9	50·9	64·9	55·4	57·2	47·5	45·2	47·2	51·9	51 0	41·4	1816	64·9	186
11	51·6	49·6	45·4	52·2	59·3	54·3	51·5	48·8	45·2	42·4	58·1	51·5	41·5	1837	63 7	184
12	51·4	56·2	49·1	48·7	51·7	56·5	51·4	53·5	46·3	45·1	56·7	51·4	38·1	1816	67·3	183
13	51·2	55·8	51·8	44·8	46·3	55·9	49·2	51·9	45·9	46·1	50·8	51·0	40·8	1816	64 9	184
14	50·9	56·8	52·0	45·3	45·2	58·3	48 9	55·2	47·9	49·3	43·9	50 8	34·5	1839	66 1	184
15	52·3	63·5	50·0	43·7	43·3	61·8	50·8	54·4	47·3	49·6	47·4	52·1	42·0	1855	72·4	183
16	53·5	60 0	48·8	46·1	45·2	60·6	49·0	54·0	49·4	54·1	46·3	53·1	40·2	1839	68 0	183
17	54·0	60·6	52·8	49·3	46·0	59·8	53·7	54·2	45·5	46·7	47·8	53·6	45·5	1832-71	72·2	183
18	53·6	65·7	54·9	52·0	49·9	58 6	52·1	59 8	50·0	41·4	46·2	53 5	41·4	1872	65 7	186
19	53·1	64·8	57·7	55·6	54·3	71·4	47·4	63·9	54·4	44·1	42·9	53·5	42 8	1840	71·4	186
20	54·2	65·2	59·6	54·0	54·6	59·0	49·0	65·2	56·5	47·8	47·2	54·5	39·8	1837	65·2	1864
21	54 0	52·9	64·7	52·3	43·6	56·0	48·8	67·2	54·5	51·7	48·0	54·0	43·6	1867	67·2	187
22	53 3	58·0	64·6	51·0	40·4	57·7	49·9	64·7	51·2	50·8	56·1	53·5	40 4	1837-67	64·7	187
23	54·6	49·9	63·4	53·4	40·7	53 5	51·6	51·6	57·7	49·7	54·6	54·3	40 7	1867	64·9	186
24	54·9	49·3	57·7	47·1	41·7	53·6	55·1	59·1	62·6	51·7	52 4	54·6	41 4	1814	63·2	183
25	54·7	52·1	58·1	49·9	44·3	57·6	57·6	56·2	67·2	52·8	54·5	54 8	42·5	1839	67·2	187
26	54·7	49·4	60·6	56 2	54·9	58·0	58·3	55·5	53·4	54·7	57 9	54·9	40·1	1821	66·2	184
27	55 1	53·4	62 9	53·5	55·6	58·2	51 1	54·3	50·5	60·1	53·6	55·1	44 8	1821	68·6	184
28	55·4	51·8	59·7	58·5	57·7	61·0	43·7	54·9	56·7	62·1	50·5	55·4	44·5	1833	72·2	184
29	55 1	48·5	61·5	55 4	61·1	63·6	44·6	61·2	56·7	59·9	52·5	55·3	44·6	1869	64·3	184
30	55·8	47·9	60·1	51·6	62·5	62·3	46·9	60·9	59·9	59·2	51·6	55·9	43 7	1855	66·1	184
31	56·4	49 2	58·4	55·4	58·3	59·2	47·8	54·5	55·1	54·2	53·2	56 1	45·4	1855	67·7	185
Means	52·9	53·8	56 1	50·1	53·4	57·3	50·5	53·4	51·9	50·9	50·6	52·9	..	..	..	..

The mean temperature of the coldest day in May in sixty years was 34°·5, on the 14t in the year 1839.

The mean temperature of the hottest day in May in sixty years was 72°·4, on the 15 in the year 1833.

The difference between these numbers is 37°·9, and it represents the extreme differen tween the mean temperature of two days in the month of May in sixty years.

The day of the month whose mean temperature has been subjected to the greatest diff 31°·6, was the 14th; and that to the least, 19°·5, was the 2nd.

TABLE VI.—JUNE.

ean Temperature and Extremes of Mean Temperature for every day in the month of June.

Days of the month.	Mean of Temperature of 50 years.	Mean Daily Temperature of the Air.										Mean of Temperature of 60 years.	Lowest and Highest Mean Daily Temperature in 60 years.				Difference between the coldest and hottest day.
		1864	1865	1866	1867	1868	1869	1870	1871	1872	1873		Lowest.	Year.	Highest.	Year.	
	°	°	°	°	°	°	°	°	°	°	°	°	°		°		°
1	57·0	50·2	55·9	56·4	63·2	58·8	50·5	55·3	54·0	53·9	50·9	56·7	48·0	1855	70·7	1858	22·7
2	57·7	51·0	54·3	62·5	65·0	57·9	57·6	59·2	47·5	50·7	57·2	57·5	47·5	1871	68·9	1834	21·4
3	57·7	50·3	58·1	62·7	55·1	58·1	58·4	57·4	47·2	54·2	58·0	57·4	47·2	1837-71	70·0	1858	22·8
4	56·9	55·5	59·9	60·4	55·6	54·4	53·0	58·0	44·9	51·5	60·9	56·7	44·9	1871	67·8	1818	22·9
5	57·1	56·7	64·7	55·3	53·5	58·9	59·1	56·7	51·2	57·3	59·9	57·1	46·0	1814	68·6	1849	22·6
6	56·7	59·7	68·9	55·4	57·5	62·7	64·6	58·6	49·9	53·1	49·8	56·9	45·9	1838	71·4	1855	25·5
7	56·8	62·5	61·3	60·3	56·4	60·0	71·8	57·0	49·0	50·2	51·4	57·0	45·0	1814	71·8	1869	26·8
8	57·4	62·4	60·4	64·8	54·2	53·8	60·5	61·9	49·3	51·3	55·0	57·4	45·9	1838	70·1	1835	24·2
9	57·9	59·2	67·0	67·8	58·5	56·3	57·7	58·4	50·4	53·9	59·3	58·1	43·5	1816	70·1	1822	26·6
10	57·4	58·6	63·3	68·5	64·1	59·9	51·9	55·1	54·5	53·8	55·8	57·6	45·5	1821	72·1	1822	26·6
11	58·4	57·8	55·1	59·0	65·8	59·8	51·6	58·5	53·7	52·7	56·3	58·2	49·1	1821	72·1	1835	23·0
12	58·5	56·4	54·0	56·8	68·4	64·1	54·8	61·6	52·8	55·9	56·4	58·4	48·6	1841	73·5	1818	24·9
13	59·0	55·3	60·5	53·4	57·7	68·2	58·2	66·4	56·0	61·3	58·9	59·1	49·1	1821	76·1	1818	27·0
14	59·6	56·6	60·2	57·7	54·0	68·8	50·8	65·9	63·1	62·8	56·0	59·6	50·0	1830	72·0	1858	22·0
15	59·4	54·5	58·3	56·3	50·9	64·6	51·9	66·1	65·4	65·1	58·3	59·4	48·0	1830	73·8	1858	25·8
16	59·0	59·3	57·7	57·9	52·6	65·9	48·8	69·5	65·4	69·5	58·7	59·3	48·8	1816-69	76·9	1858	28·1
17	58·7	60·7	58·7	50·7	51·0	68·7	47·4	61·5	59·9	71·8	61·1	58·8	46·6	1832	71·8	1872	25·2
18	58·5	61·6	52·6	50·6	58·4	62·4	50·7	60·9	59·5	70·4	58·9	58·5	48·7	1823	72·6	1839	23·9
19	59·2	58·7	54·8	57·2	59·3	59·7	51·4	66·5	58·9	67·8	59·6	59·2	51·4	1869	70·5	1817	19·1
20	59·5	61·1	60·1	56·4	56·6	67·4	50·5	67·2	56·1	64·4	61·9	59·6	50·5	1869	71·2	1846	20·7
21	60·0	60·8	65·8	66·7	54·6	69·9	49·2	68·8	57·7	61·4	64·4	60·3	49·2	1869	75·8	1817	26·6
22	59·7	57·5	62·6	63·8	54·5	58·8	53·6	72·9	53·5	59·5	68·9	59·8	48·7	1823	72·9	1870	24·2
23	61·1	55·3	68·1	61·2	59·1	58·8	55·7	60·4	55·0	60·9	62·5	60·9	49·4	1814	68·3	1858	18·9
24	61·0	56·0	64·0	62·3	58·6	60·4	54·9	54·6	52·4	65·3	58·2	60·6	48·8	1835	71·3	1844	22·5
25	61·3	60·0	61·8	61·2	59·3	63·2	58·1	56·0	49·9	61·4	57·8	60·9	45·1	1835	71·5	1820	26·4
26	62·0	56·6	59·8	67·7	58·4	64·2	58·3	59·1	52·4	56·9	57·5	61·5	47·1	1835	73·1	1820	26·0
27	61·7	54·0	61·7	69·6	62·2	69·8	60·7	59·9	55·1	58·0	65·7	61·7	47·6	1835	74·8	1818	27·2
28	62·2	55·3	60·2	69·7	57·7	63·8	57·1	57·2	59·0	61·5	63·6	61·9	51·8	1831	74·2	1826	22·4
29	61·3	59·9	59·3	65·1	58·7	60·1	54·6	58·7	60·4	57·8	65·5	61·1	46·7	1839	70·2	1826	23·5
30	61·4	59·2	56·9	68·4	63·3	61·4	55·1	58·0	59·3	61·3	58·0	61·2	47·7	1839	70·6	1826	22·9
ans	59·1	57·4	60·2	60·9	58·1	62·0	55·3	60·9	54·8	59·2	58·9	59·1	..	..	..	..	..

he mean temperature of the coldest day in June in sixty years was 43°·5, on the 9th day in year 1816

he mean temperature of the hottest day in June in sixty years was 76°·9, on the 16th day e year 1858.

he difference between these numbers is 33°·4, and it represents the extreme difference be- en the mean temperature of two days in the month of June in sixty years.

he day of the month whose mean temperature has been subjected to the greatest difference, , was the 16th; and that to the least, 18°·9, was the 23rd.

TABLE VII.—JULY.

Mean Temperature and Extremes of Mean Temperature for every day in the month of Jul

Days of the Month.	Mean of Temperature of 50 years.	Mean Daily Temperature of the Air.										Mean of Temperature of 60 years.	Lowest and Highest Mean Daily Temperatur in 60 years.			
		1864	1865	1866	1867	1868	1869	1870	1871	1872	1873		Lowest.	Year.	Highest.	Year.
	°	°	°	°	°	°	°	°	°	°	°	°	°		°	
1	59·8	57·5	57·0	57·6	66·0	59·6	57·1	54·4	60·1	60·5	60·9	59·7	52·0	1816	73·3	1836
2	60·5	59·2	61·9	57·6	61·9	64·7	56·7	56·5	57·1	63·0	62·6	60·4	51·0	1821	75·0	1836
3	61·1	56·4	64·5	54·7	60·5	65·6	57·1	56·1	60·9	61·7	65·0	61·0	51·0	1821	72·1	1828
4	62·0	57·9	68·6	54·9	61·6	56·2	62·5	66·3	57·7	66·2	61·5	61·9	53·6	1823	74·7	1836
5	62·8	59·7	69·4	57·1	60·4	59·4	64·4	64·4	58·9	70·8	57·8	62·7	51·7	1820	76·7	1836
6	62·5	56·5	69·6	56·6	59·4	62·1	64·5	63·2	60·3	68·0	59·9	62·4	54·7	1820-21	74·0	1848
7	61·4	57·3	64·4	55·7	59·0	64·6	63·7	67·8	65·9	70·7	64·1	61·7	52·0	1821	73·1	1826
8	60·8	53·5	64·2	57·6	58·3	68·3	66·6	69·6	62·7	60·5	65·7	61·1	48·0	1856	72·6	1826
9	61·0	54·3	61·8	66·1	59·3	70·4	63·7	67·6	62·2	60·0	62·7	61·3	53·0	1856	71·3	1826
10	61·6	59·9	60·1	70·6	60·6	66·8	63·9	68·3	61·0	62·3	65·2	62·0	53·9	1860	71·8	1836
11	62·1	66·1	59·5	69·4	59·8	68·3	63·9	64·7	54·2	66·8	61·0	62·3	51·7	1841	72·3	1836-59
12	62·6	60·8	58·2	70·8	62·5	66·0	70·4	63·5	58·6	63·3	59·7	62·7	52·0	1854	75·7	1859
13	62·5	57·3	58·1	73·4	60·4	68·1	59·9	62·6	62·0	58·0	57·4	62·4	51·2	1833	75·2	1859
14	62·6	59·8	64·2	69·7	62·0	68·0	62·9	66·8	65·5	60·8	58·	62·8	54·5	1841	73·3	1824
15	62·9	61·7	67·7	69·5	56·7	72·1	66·5	68·8	68·5	56·0	57·1	63·2	54·2	1841	79·1	1825
16	61·8	59·9	69·6	64·0	57·3	75·9	71·1	65·4	69·1	62·6	60·5	62·4	50·7	1834	75·9	1868
17	62·6	64·5	67·1	63·3	59·7	72·6	73·5	63·0	67·9	57·7	63·	63·1	53·6	1823	76·7	1834
18	62·1	65·4	60·4	60·5	58·6	72·5	73·3	63·0	67·3	59·5	59·"	62·4	52·3	1816	78·2	1825
19	61·3	68·9	60·4	59·5	58·1	69·2	63·1	71·0	66·9	64·6	59·0	61·8	53·9	1834	78·6	1825
20	61·6	69·8	63·0	56·2	60·3	72·0	59·0	71·8	63·5	69·0	66·7	62·2	47·7	1836	71·8	1870
21	61·2	67·0	62·0	62·2	64·0	76·6	63·9	72·5	63·2	72·4	71·7	62·3	53·3	1819	76·6	1868
22	61·5	63·7	62·5	59·3	62·7	77·9	72·9	72·0	60·9	68·7	75·2	62·5	53·2	1832	77·9	1868
23	61·4	66·1	65·0	57·7	61·4	63·3	66·6	66·1	59·5	68·1	72·3	61·9	53·8	1826-60	72·7	1818
24	61·7	64·0	66·4	59·4	61·2	61·6	63·4	69·8	60·4	70·6	65·2	62·1	54·0	1838	79·2	1818
25	61·8	59·3	66·8	58·3	59·5	63·8	65·3	71·7	58·8	75·5	68·3	62·3	53·6	1860	75·5	1872
26	61·4	64·0	66·4	60·4	53·4	68·8	64·9	66·1	59·7	73·9	62·4	61·8	53·1	1829	73·9	1872
27	62·2	62·9	69·2	59·0	52·2	74·0	64·9	67·4	62·1	68·5	62·0	62·5	51·6	1823	74·0	1837-68
28	62·6	63·2	62·8	61·2	55·3	74·4	59·0	57·6	61·4	67·0	61·0	62·6	54·7	1817	74·6	1814
29	62·5	65·7	65·4	60·2	55·4	58·5	62·2	58·2	60·8	67·9	64·1	62·4	52·0	1816	73·9	1827
30	62·3	66·2	62·4	58·2	55·1	64·7	65·8	63·1	55·2	61·0	69·1	62·3	53·2	1841	76·3	1830
31	62·3	66·8	58·7	51·3	58·6	66·2	66·1	67·9	60·7	57·9	66·5	62·3	51·3	1866	74·8	1826
Means	61·8	61·8	63·8	61·0	59·4	67·5	64·5	65·4	61·7	65·0	63·4	62·1	..	..	..	..

The mean temperature of the coldest day in July in sixty years was 47°·7, on the 20th the year 1836.

The mean temperature of the hottest day in July in sixty years was 79°·2, on the 24 in the year 1818.

The difference between these numbers is 31°·5, and it represents the extreme difference b the mean temperature of two days in the month of July in sixty years.

The day in the month whose mean temperature has been subjected to the greatest diff 25°·9, was the 18th; and that to the least, 17°·9, was the 10th.

TABLE VIII.—AUGUST.

an Temperature and Extremes of Mean Temperature for every day in the month of August.

Days of the month.	Mean of Temperature of 50 years.	Mean Daily Temperature of the Air.										Mean of Temperature of 60 years.	Lowest and Highest Mean Daily Temperature in 60 years.				Difference between the coldest and hottest day.
		1864	1865	1866	1867	1868	1869	1870	1871	1872	1873		Lowest.	Year.	Highest.	Year.	
	°	°	°	°	°	°	°	°	°	°	°	°	°		°		°
1	62·4	64·1	54·4	57·8	54·6	66·4	61·5	67·4	60·9	62·4	60·8	62·2	54·0	1841	75·3	1825	21·3
2	62·5	59·7	52·4	63·7	51·1	68·9	58·5	62·9	62·9	58·3	62·4	62·1	52·4	1865	74·2	1856	21·8
3	62·5	58·7	50·4	61·4	55·0	70·3	56·6	62·6	65·2	57·6	63·6	62·1	50·4	1865	72·6	1857	22·2
4	62·7	67·3	54·3	58·8	59·7	73·2	64·4	66·1	57·6	54·6	62·6	62·6	51·3	1854	73·2	1868	21·9
5	62·0	71·6	58·6	57·1	60·9	74·2	62·7	65·9	59·6	58·9	66·3	62·3	53·4	1854	74·2	1818-68	20·8
6	61·4	66·9	62·9	55·2	55·9	67·6	56·9	64·4	67·0	61·8	68·2	61·6	54·0	1823	74·5	1818	20·5
7	61·8	64·0	64·5	60·6	55·7	67·9	57·7	60·6	64·7	60·0	69·0	61·9	55·3	1823	69·4	1840	14·1
8	62·0	69·2	60·6	59·6	63·1	66·5	58·7	65·6	67·5	58·2	71·5	62·3	53·9	1860	71·5	1873	17·6
9	61·8	58·3	61·8	58·6	63·3	64·8	64·2	65·0	67·3	59·2	60·8	61·9	56·4	1848-60	68·9	1842	12·5
0	62·3	55·8	62·6	55·5	62·3	69·5	56·6	63·7	69·4	61·4	57·6	62·2	55·1	1845	73·2	1842	18·1
1	62·7	57·6	61·9	57·5	63·5	65·5	56·0	64·1	69·6	59·2	58·0	62·5	55·9	1844	74·9	1835	19·0
2	62·3	60·1	59·7	58·8	70·9	62·6	57·3	66·9	72·4	59·5	64·1	62·5	54·3	1852	72·9	1861	18·6
3	62·3	63·1	61·0	61·4	71·2	60·1	59·4	65·7	73·9	57·2	65·9	62·6	53·8	1830	73·9	1871	20·1
4	61·2	63·0	60·3	58·9	75·5	61·3	57·3	62·8	70·9	60·7	65·1	61·6	53·0	1828	75·5	1867	22·5
5	61·0	63·7	59·9	57·7	60·6	66·5	59·1	61·9	66·9	59·3	65·5	61·2	52·5	1829	69·8	1842	17·3
6	61·3	59·7	60·2	55·1	59·8	65·6	61·7	62·2	66·7	62·1	68·4	61·4	52·5	1845	69·1	1842	16·6
7	60·9	60·8	59·5	56·2	61·4	62·7	58·1	60·8	67·9	66·5	59·5	61·0	53·5	1830	74·4	1837	20·9
8	61·0	55·9	59·6	57·7	64·9	63·7	57·4	63·4	62·6	65·8	59·3	60·8	52·5	1830	74·3	1842	21·8
9	61·2	57·4	59·8	60·7	67·6	63·2	57·2	58·2	60·8	64·0	58·2	61·1	50·7	1839	71·7	1837	21·0
0	60·6	56·7	62·6	61·6	63·0	59·6	57·9	57·2	63·1	65·5	58·6	60·6	47·0	1839	73·3	1826	26·3
1	60·7	53·4	63·2	59·8	61·5	61·8	59·6	57·3	67·2	67·2	60·8	60·8	49·4	1839	71·0	1835	21·6
2	60·2	53·5	64·7	60·4	62·1	57·0	62·9	55·6	64·4	64·8	62·3	60·3	50·2	1817	71·9	1822	21·7
3	60·9	49·5	56·8	60·2	63·3	57·4	63·7	57·0	62·1	62·2	61·6	60·7	49·5	1864	72·4	1857	22·9
4	60·4	52·4	63·8	63·4	63·3	57·5	67·6	60·1	60·9	60·8	64·1	60·6	52·4	1864	73·6	1857	21·2
5	60·6	50·6	60·2	62·3	65·1	58·4	70·0	58·1	62·8	67·3	67·4	60·9	50·6	1864	73·4	1859	22·8
6	60·3	53·0	60·8	66·0	59·9	57·7	71·3	56·1	60·6	59·9	64·3	60·4	51·2	1817	71·3	1869	20·1
7	60·5	53·0	61·9	64·3	55·6	60·3	71·5	56·9	58·2	56·5	63·2	60·4	53·0	1864	71·5	1869	18·5
8	60·1	58·3	64·4	60·7	57·8	56·9	71·9	59·7	61·0	57·8	60·0	60·2	52·6	1814	71·9	1869	19·3
9	60·0	65·2	56·6	55·0	63·4	58·4	58·1	56·6	63·1	61·8	54·3	59·9	49·3	1832	71·0	1826	21·7
0	59·8	65·3	58·6	58·1	62·3	62·1	55·2	53·8	66·7	58·9	59·7	59·9	49·3	1837	70·6	1826	21·3
1	58·5	59·3	59·6	58·2	67·6	62·8	55·1	55·1	65·4	58·3	61·9	58·8	43·2	1833	69·0	1825	25·8
ıns	61·2	59·6	59·9	59·4	62·0	63·6	60·8	61·1	64·8	60·9	62·7	61·3	..	..	..	..	..

he mean temperature of the coldest day in August in sixty years was 43°·2, on the 31st day he year 1833.
he mean temperature of the hottest day in August in sixty years was 75°·5, on the 14th day he year 1867.
he difference between these numbers is 32°·3, and it represents the extreme difference be- en the mean temperature of two days in the month of August in sixty years.
he day of the month whose mean temperature has been subjected to the greatest difference, 3, was the 20th; and that to the least, 12°·5, was the 9th.

TABLE IX.—SEPTEMBER.

Mean Temperature and Extremes of Mean Temperature for every day in the month of September.

Days of the Month.	Mean of Temperature of 50 years.	Mean Daily Temperature of the Air.										Mean of Temperature of 60 years.	Lowest and Highest Mean Daily Temperature in 60 years.				Difference between the coldest and hottest day.
		1864	1865	1866	1867	1868	1869	1870	1871	1872	1873		Lowest.	Year.	Highest.	Year.	
	°	°	°	°	°	°	°	°	°	°	°	°	°		°		°
1	58·9	57·2	61·4	59·1	67·9	63·4	54·9	59·4	66·6	58·2	59·7	59·2	44·5	1816	71·7	1824	27·2
2	58·8	57·4	67·2	54·5	65·6	63·4	54·6	60·9	67·1	66·6	58·8	59 3	45·5	1816	73·5	1824	28·0
3	59·1	59·6	66·5	55·6	64·8	67·6	53·8	58·2	63·3	69·5	53·4	59·5	46·8	1816	70 5	1824	23·7
4	57·7	58·5	66·1	59·7	62·7	69·4	60·8	57·4	60·5	68·0	54·7	58·4	47 8	1816	69·4	1868	21·6
5	58·4	57·9	65·9	61·7	60·5	68·1	66·4	60·5	61·0	64·3	52·3	59·0	48·8	1841	68·1	1848-68	19·3
6	57·9	59·8	65·7	60·0	59·6	69·4	62·0	57·8	61·5	62·6	51·1	58·4	47·9	1841	69·4	1868	21·5
7	57·8	65·0	69·4	60·4	61·5	73·2	64·8	52·5	62·5	62·2	53·0	58·6	48·8	1815	73 2	1868	24·4
8	58·0	66·8	72·1	57·4	61·0	62·0	66·7	55·4	58·4	59·6	53·0	58·5	47·1	1838	72·1	1865	25·0
9	57·8	63·1	66·2	58·5	61·7	61·0	64·5	59·9	56·6	61·2	54·7	58·3	48·8	1831	66·2	1865	17·4
10	57·5	56·3	66·0	59·9	58·9	61·0	59·6	55·6	64·3	59·1	57·7	57 9	47·4	1836	66·0	1865	18·6
11	57·1	52·2	67·8	56·2	58·8	60·3	60·7	53·9	65·9	65·9	56·7	57·6	47·0	1836	67·8	1865	20·8
12	57·1	53·4	66·8	52·8	62·9	61·1	53·8	56·8	64·8	64·6	55·8	57·5	47·3	1848	68·7	1841	21·4
13	57·0	54·0	67·6	57·3	59·0	56·0	55·5	54·5	61·3	66·5	52·4	57·2	49·9	1848	67·6	1865	17·7
14	57·3	57·8	65·6	56·1	58·1	56·2	59·5	54·0	59·6	61·9	55·3	57·5	50·4	1840	69·5	1823	19·1
15	57·2	56·1	69·0	56·1	56·7	56·9	57·6	50·5	61·8	62·0	50·1	57·3	46·4	1840	69 0	1865	22·6
16	57·5	56·3	71·7	53·1	53·0	57·6	58·5	52·1	60·4	56·7	52·4	57·5	47·7	1840	71·7	1865	24·0
17	57·5	54·2	66·6	53·5	52·0	58·5	60·0	56·2	56·4	61·2	57·4	57·5	49·4	1840	66·7	1857	17·3
18	56·3	54·9	63·6	53·9	56·6	57·9	61·6	57·1	56·3	55·5	54·2	56·4	48·1	1840	66·0	1843	17·9
19	55·5	53·2	62·7	58·0	57·5	56·5	54·0	52·7	54·1	53·2	55·3	55·5	45·2	1820	65 9	1843	20·7
20	55·6	53·2	64·1	54·8	53·7	60·5	51·9	53·6	54·1	46·4	60·0	55·5	46·4	1872	65·7	1825	19·3
21	54·5	58·8	57·0	53·9	53·9	59·1	52·4	54·9	55·0	45·4	55·9	54·5	44·0	1836	63·2	1825	19·2
22	55·5	58·7	57·5	49·0	56·7	60·3	55·2	55·9	51·2	44·6	49·8	55 2	44·6	1872	62·7	1858	18·1
23	55·2	56·1	54·7	51·2	55·7	56·8	58·9	54·2	47·9	48·8	51·9	54·9	47·1	1845	63·2	1858	16·1
24	55·8	57·4	59·8	53·7	50·3	57·0	63·6	53·4	47·4	44·6	52·3	55·5	44·3	1845	67·4	1859	23·1
25	55·3	55·9	58·8	53·4	48·0	54·7	61·9	51·5	48·9	47·6	58·3	55·1	44·7	1840	65·2	1825	20·5
26	54·8	55·6	61·3	56·3	49·3	60·2	59·0	55·8	48·2	48·1	55·9	54·8	43·8	1824	63 7	1828	19·9
27	54·2	55·7	61·5	54·4	54·8	59·5	55·7	57·3	55·5	54·0	56 9	54·6	43·3	1824	62·2	1849	18·9
28	54·3	54·9	57·7	58·1	56·3	56·6	57·2	58·5	52·3	55·5	56·5	54·6	40·7	1824	61·7	1826	21·0
29	53·9	53·5	57·8	61·2	54·9	57·5	64·0	57·6	51·3	53·3	50·7	54·3	46·2	1823	64·0	1869	17·8
30	53·9	53·7	58·5	61·0	56·1	53·2	61·3	54·2	47·6	53·5	53 9	54·1	44 7	1829	62·5	1819	17·8
Means	56·6	56·9	63·9	56·4	57·6	60·5	59·0	55·7	57·4	57·4	54·7	56·8	..	..	..	..	..

The mean temperature of the coldest day in September in sixty years was 40°·7, on the 28th day, in the year 1824.

The mean temperature of the hottest day in September in sixty years was 73°·5, on the 2nd day in the year 1824.

The difference between these numbers is 32°·8, and it represents the extreme difference between the mean temperature of two days in the month of September in sixty years.

The day of the month whose mean temperature has been subjected to the greatest difference, 28°·0, was the 2nd; and that to the least, 16°·1, was the 23rd.

TABLE X.—OCTOBER.

n Temperature and Extremes of Mean Temperature for every day in the month of October.

Days of the month.	Mean of Temperature of 50 years.	Mean Daily Temperature of the Air.										Mean of Temperature of 60 years.	Lowest and Highest Mean Daily Temperature in 60 years.				Difference between the coldest and hottest day.
		1864	1865	1866	1867	1868	1869	1870	1871	1872	1873		Lowest.	Year.	Highest.	Year.	
	°	°	°	°	°	°	°	°	°	°	°	°	°		°		°
1	54·1	52·1	59·0	56·1	49·1	52·8	58·0	54·7	52·5	55·6	59·4	54·2	44·2	1823	64·3	1861	20·1
2	53·9	51·0	59·8	56·9	50·0	50·9	56·2	55·5	52·2	58·5	61·1	54·1	37·7	1817	61·7	1837	24·0
3	54·1	49·8	59·8	61·8	44·6	45·6	56·0	56·3	49·5	53·0	63·0	54·1	39·9	1817	63·9	1859	24·0
4	54·4	47·4	54·8	57·5	41·2	50·2	54·7	51·5	49·2	45·2	55·5	53·8	41·2	1867	66·8	1859	25·6
5	53·0	48·4	54·4	55·0	41·3	55·0	52·5	51·5	52·0	47·4	51·2	52·7	41·3	1867	64·5	1834	23·2
6	52·4	49·9	54·2	56·7	41·8	54·9	54·5	49·8	56·1	47·1	53·8	52·3	41·8	1867	63·2	1848	21·4
7	53·1	51·2	53·7	55·0	47·2	49·0	56·3	55·7	52·1	50·6	52·1	53·0	37·4	1829	63·7	1848	26·3
8	52·1	50·5	57·6	56·4	43·5	50·1	61·5	58·4	46·3	51·6	42·3	52·1	39·7	1829	62·1	1861	22·4
9	51·2	50·8	58·9	53·8	41·5	51·5	61·3	48·1	44·9	49·4	46·1	51·1	38·7	1829	61·3	1869	22·6
10	52·0	50·8	57·5	53·6	43·8	51·6	59·9	42·9	44·7	46·8	59·4	51·9	38·0	1814	62·5	1819	24·5
11	52·4	50·5	57·6	51·7	41·3	49·0	59·9	43·4	45·8	43·0	59·4	52·0	41·3	1867	62·2	1819	20·9
12	51·1	52·8	53·8	50·4	46·9	53·2	57·8	49·7	44·3	42·3	49·9	50·9	38·6	1860	60·9	1826	22·3
13	50·9	50·9	50·9	45·9	42·9	51·1	54·5	52·3	45·0	43·1	46·6	50·5	36·0	1838	59·7	1826	23·7
14	51·0	50·9	51·1	48·4	54·0	47·5	46·8	47·7	47·5	41·2	45·3	50·5	41·2	1872	62·3	1861	21·1
15	50·0	45·6	49·1	44·3	57·9	49·9	52·2	45·5	47·2	39·6	47·2	49·6	38·3	1843	59·2	1826	20·9
16	49·5	51·7	49·8	43·9	55·2	49·7	50·2	51·5	54·1	44·9	48·6	49·6	35·8	1843	60·2	1818	24·4
17	49·3	53·8	53·1	48·2	56·0	47·2	39·5	47·4	56·0	46·8	48·7	49·4	36·4	1824	56·9	1818	20·5
18	49·3	53·7	49·0	49·0	52·8	42·6	42·2	50·1	56·6	47·8	52·5	49·4	38·0	1848	59·7	1849	21·7
19	50·3	58·1	42·6	57·5	48·4	38·2	39·5	50·5	58·5	47·3	49·9	50·1	36·4	1843	59·5	1849	23·1
20	49·7	51·7	42·9	56·0	43·9	37·0	39·5	46·2	53·6	51·4	44·6	49·2	36·2	1842	59·1	1849	22·9
21	48·8	50·3	41·3	56·9	51·1	43·6	46·0	49·6	48·7	50·6	44·3	48·7	35·6	1842	60·7	1826	25·1
22	49·5	52·4	46·4	50·7	59·0	43·3	43·3	52·5	47·1	44·5	52·2	49·4	35·5	1819	60·7	1826	25·2
23	48·9	49·9	47·1	50·5	53·9	45·7	49·0	50·6	46·3	41·1	42·9	48·7	33·3	1859	58·7	1826	25·4
24	48·1	48·3	51·4	52·4	53·4	47·5	45·3	48·4	42·0	46·7	40·4	48·0	32·1	1859	57·4	1826-49	25·3
25	47·4	48·8	48·7	44·6	51·2	51·2	42·6	47·3	45·4	48·4	39·5	47·3	35·2	1819	58·6	1861	23·4
26	46·2	52·4	48·0	45·9	51·9	46·6	38·5	45·1	45·1	49·0	42·6	46·3	37·5	1819	56·0	1853	18·5
27	46·9	53·3	47·7	42·6	45·8	42·1	34·7	47·4	52·4	49·9	39·7	46·7	34·5	1819	57·5	1853	23·0
28	47·3	51·4	39·1	48·6	41·1	43·6	35·1	48·0	50·1	47·7	34·6	46·7	35·1	1869	59·9	1831	24·8
29	45·5	50·0	44·4	43·6	51·3	45·3	41·3	50·8	49·4	49·2	35·1	45·6	28·4	1836	55·5	1847	27·1
30	46·5	43·0	47·0	51·0	53·6	46·1	42·5	47·4	48·9	54·2	31·8	46·5	30·6	1836	56·7	1822	26·1
31	46·7	43·9	45·9	43·9	55·4	52·5	43·4	48·8	49·3	49·0	43·5	46·8	31·4	1836	57·0	1854	25·6
Means	50·2	50·5	50·9	51·3	48·7	47·9	48·9	49·8	49·4	47·8	47·8	50·1	..	..	..	..	..

he mean temperature of the coldest day in October in sixty years was 28°·4, on the 29th day he year 1836.

he mean temperature of the hottest day in October in sixty years was 66°·8, on the 4th day ie year 1859.

ie difference between these numbers is 38°·4, and it represents the extreme difference be-n the mean temperature of two days in the month of October in sixty years.

ie day of the month whose mean temperature has been subjected to the greatest difference, , was the 29th; and that to the least, 18°·5, was the 26th.

TABLE XI.—NOVEMBER.

Mean Temperature and Extremes of Mean Temperature for every day in the month of November.

Days of the Month.	Mean of Temperature of 50 years.	Mean Daily Temperature of the Air.										Mean of Temperature of 60 years.	Lowest and Highest Mean Daily Temperature in 60 years.				Difference between the coldest and hottest day.
		1864	1865	1866	1867	1868	1869	1870	1871	1872	1873		Lowest.	Year.	Highest.	Year.	
	°	°	°	°	°	°	°	°	°	°	°	°	°		°		°
1	47·1	44·4	39·1	51·2	50·3	54·5	48·2	46·1	47·0	50·9	45·0	47·2	34·0	1829	57·7	1821	23·7
2	47·0	43·5	41·4	54·4	41·7	47·4	51·7	41·1	45·7	47·3	45·1	46·8	34·5	1823	59·7	1821	25·2
3	46·0	42·7	42·0	51·8	40·7	49·0	48·6	36·1	45·8	46·3	44·2	45·8	33·1	1820	58·8	1857	25·7
4	45·5	37·0	37·8	47·7	47·2	49·8	47·3	42·4	44·7	47·7	41·3	45·3	34·7	1815	56·0	1863	21·3
5	46·4	42·5	38·9	53·9	41·4	38·4	44·3	46·6	40·4	55·7	47·4	46·2	36·4	1820	57·7	1834	21·3
6	46·1	40·6	41·3	51·3	39·8	33·5	42·5	43·3	37·9	55·8	46·4	45·6	33·5	1868	57·5	1834	24·0
7	45·5	36·3	42·3	51·4	40·7	34·5	40·1	42·9	43·4	49·7	45·3	45·0	33·6	1837	56·9	1852	23·3
8	43·9	36·9	46·1	52·4	41·4	36·3	46·4	41·4	43·1	51·1	44·4	43·9	29·0	1816	58·3	1852	29·3
9	42·9	39·9	45·0	42·5	42·3	38·5	43·6	38·8	37·5	45·7	44·2	42·7	34·5	1843	55·9	1852	21·4
10	43·9	34·9	41·3	39·4	44·7	39·6	35·8	35·6	38·0	39·0	44·4	43·1	32·4	1816	55·0	1824	22·6
11	44·2	35·9	41·8	49·4	42·4	42·4	34·7	36·4	34·4	38·9	41·6	43·5	29·4	1828	54·7	1821	25·3
12	43·7	37·9	44·7	48·9	39·6	43·2	38·3	35·1	32·2	39·3	38·2	43·0	28·8	1828	53·4	1829	24·6
13	42·7	44·6	42·2	50·4	42·4	42·7	48·6	37·5	30·6	36·6	35·3	42·4	29·3	1825	53·3	1827	24·0
14	42·3	46·2	45·0	43·1	48·9	42·4	54·2	42·7	39·2	36·4	41·2	42·6	33·7	1820	55·0	1821	21·3
15	41·9	43·7	45·3	43·3	53·5	37·8	53·6	33·7	45·3	37·8	41·0	42·2	31·3	1851	58·0	1821	26·7
16	42·3	43·7	41·9	49·1	43·7	38·1	51·2	38·0	37·1	37·3	41·9	42·3	32·0	1861	56·9	1840	24·9
17	41·7	45·7	51·0	34·8	39·9	42·7	37·9	35·7	33·6	36·0	42·7	41·4	30·0	1815	55·4	1817	25·4
18	41·8	47·4	43·6	43·4	39·2	43·1	39·0	36·8	29·0	36·8	42·7	41·5	27·1	1861	51·3	1824	24·2
19	41·3	46·9	50·4	34·6	41·9	41·4	47·4	38·7	30·1	39·9	43·3	41·3	26·9	1815	51·8	1822-45	24·9
20	42·0	47·4	52·3	32·9	37·7	35·2	37·2	42·5	36·2	47·1	41·0	41·8	26·1	1829	52·8	1822	26·7
21	42·5	43·5	50·8	36·1	38·5	40·2	36·9	44·0	32·5	48·1	41·2	42·3	29·1	1829	52·5	1831	23·4
22	42·0	44·9	50·4	41·3	39·3	49·6	43·3	45·8	35·4	46·8	50·3	42·5	28·3	1827	53·3	1831	25·0
23	40·2	42·2	49·2	45·1	40·8	45·5	39·8	46·7	34·2	52·5	50·7	41·0	24·6	1827	53·5	1831	28·9
24	40·9	38·3	50·0	41·2	38·3	38·5	39·3	52·5	36·5	49·1	47·2	41·3	23·4	1816	53·9	1846	30·5
25	40·5	38·5	50·8	43·4	37·3	40·7	37·5	49·5	35·1	48·1	43·7	40·8	30·0	1838	52·8	1863	22·8
26	41·5	39·6	45·6	41·7	42·6	43·4	46·5	46·7	39·0	52·6	51·0	42·1	27·7	1826	53·1	1861	25·4
27	40·4	42·2	40·6	44·7	34·7	40·6	43·5	42·3	37·5	50·0	46·7	40·7	28·5	1854	52·1	1843	23·6
28	42·0	48·8	46·4	34·5	34·2	39·4	41·4	42·5	36·6	45·0	45·9	41·9	26·1	1849	54·4	1828	28·3
29	42·4	41·3	43·8	39·4	36·6	35·6	36·4	43·8	35·1	44·2	50·5	42·1	29·0	1815	53·7	1818	24·7
30	42·4	43·9	43·7	34·9	40·4	40·6	34·8	38·9	35·7	47·1	41·3	42·0	28·5	1856	52·5	1823	24·0
Means	43·1	42·0	44·8	44·3	41·4	41·5	43·0	41·5	37·6	45·3	44·2	43·0	..	..	..	..	..

The mean temperature of the coldest day in November in sixty years was 23°·4, on the 24th day in the year 1816.

The mean temperature of the hottest day in November in sixty years was 59°·7, on the 2nd day in the year 1821.

The difference between these numbers is 36°·3, and it represents the extreme difference between the mean temperature of two days in the month of November in sixty years.

The day of the month whose mean temperature has been subjected to the greatest difference, 30°·5, was the 24th; and those to the least, 21°·3, were the 4th, 5th and 14th.

TABLE XII.—DECEMBER.

Mean Temperature and Extremes of Mean Temperature for every day in the month of December.

Days of the month.	Mean of Temperature of 50 years.	Mean Daily Temperature of the Air.										Mean of Temperature of 60 years.	Lowest and Highest Mean Daily Temperature in 60 years.				Difference between the coldest and hottest day.
		1864	1865	1866	1867	1868	1869	1870	1871	1872	1873		Lowest.	Year.	Highest.	Year.	
	°	°	°	°	°	°	°	°	°	°	°	°	°		°		°
1	42·6	41·9	44·3	32·5	49·9	42·1	32·3	35·5	38·4	46·0	43·2	42·3	28·9	1846	54·2	1832	25·3
2	42·5	38·6	41·6	39·2	29·6	46·4	31·2	32·3	32·6	44·1	48·9	41·4	27·7	1856	52·9	1838	25·2
3	41·0	46·9	42·0	48·7	33·4	48·9	30·4	36·9	33·9	44·0	46·9	41·0	30·4	1869	53·9	1847	23·5
4	41·9	46·1	46·3	53·4	32·6	51·6	32·6	33·4	29·8	37·2	40·2	41·6	29·8	1871	53·4	1866	23·6
5	43·1	48·3	45·9	52·4	36·4	53·7	34·6	30·3	28·8	35·1	42·4	42·7	28·8	1871	53·7	1868	24·9
6	42·0	46·5	48·7	52·0	35·4	53·9	37·0	35·0	34·2	44·7	40·1	42·1	26·4	1844	53·9	1868	27·5
7	42·2	45·8	50·5	45·6	33·0	49·4	36·0	34·4	30·7	42·1	42·1	42·0	28·2	1844	56·0	1856	27·8
8	41·4	43·8	46·9	36·9	32·6	50·9	40·0	29·4	22·4	44·3	40·4	41·0	22·4	1871	55·3	1856	32·9
9	40·8	43·1	45·1	41·5	25·8	42·6	39·8	31·7	29·0	41·5	29·7	40·2	25·8	1867	55·1	1856	29·3
10	40·5	40·4	42·1	43·2	33·2	48·3	41·2	33·6	34·0	37·1	24·6	40·0	24·6	1873	54·3	1848	29·7
11	39·5	45·7	41·9	35·3	43·6	49·9	46·0	34·3	34·5	36·7	28·3	39·5	20·9	1819	52·9	1852	32·0
12	40·3	43·8	39·9	48·2	46·7	38·5	40·5	42·1	39·5	31·3	34·6	40·3	27·8	1844	54·6	1814	26·8
13	40·3	41·8	36·9	49·3	42·5	44·9	46·8	47·3	41·8	40·3	35·3	40·7	25·5	1846	53·3	1848	27·8
14	40·5	39·0	40·4	42·7	44·2	50·3	42·2	52·5	43·7	38·7	34·7	40·9	24·5	1846	52·5	1870	28·0
15	40·6	33·9	38·4	43·5	50·6	51·4	42·4	45·2	42·3	44·4	41·3	41·1	23·5	1840	53·8	1849	30·3
16	40·4	32·5	38·4	43·1	50·9	47·1	46·0	40·3	43·3	39·4	50·8	40·9	25·1	1859	50·9	1833-49-67	25·8
17	40·1	24·4	43·5	44·7	47·9	47·7	43·2	37·6	39·1	42·0	49·8	40·4	22·8	1859	52·5	1857	29·7
18	40·6	29·5	41·2	49·7	36·5	49·7	51·6	42·3	45·2	38·3	50·2	41·1	23·4	1859	53·9	1814	30·5
19	39·6	34·7	42·6	42·6	35·3	41·4	45·4	48·7	44·9	38·7	47·5	40·0	23·9	1859	52·6	1819	28·7
20	39·6	42·0	44·7	36·1	27·9	41·4	40·0	42·1	42·7	41·3	43·4	39·7	24·4	1855	52·6	1819	28·2
21	39·5	38·9	47·6	35·4	38·0	49·2	38·4	27·7	40·5	46·6	47·4	39·3	20·2	1855	53·1	1828	32·9
22	38·2	34·3	40·3	37·3	43·5	47·8	37·4	23·4	38·7	51·2	44·0	38·5	21·2	1816	51·6	1819	30·4
23	38·0	31·3	38·7	41·9	38·4	42·4	39·9	24·1	40·2	48·2	42·6	38·1	22·5	1840	51·7	1857	29·2
24	38·0	30·7	32·3	39·7	41·4	45·1	35·4	22·5	41·0	47·1	42·7	38·0	18·4	1830	50·5	1839	32·1
25	37·2	33·4	42·4	40·9	37·9	40·2	30·9	20·6	40·9	49·9	41·6	37·3	18·6	1830	53·1	1824	34·5
26	36·7	33·1	45·5	46·4	32·1	43·5	27·0	28·3	44·5	48·4	44·3	37·1	22·3	1835	49·1	1852	26·8
27	37·1	31·7	36·9	44·8	34·2	49·0	28·5	26·2	44·7	47·5	37·9	37·3	23·5	1829	50·2	1852	26·7
28	36·7	37·4	44·3	47·5	32·6	43·8	26·3	29·6	45·9	48·5	28·8	37·0	23·1	1822	48·5	1872	25·4
29	37·1	41·7	47·1	46·7	34·2	40·9	34·6	27·9	40·7	46·9	32·4	37·5	23·0	1860	49·9	1833	26·9
30	38·8	38·0	40·2	36·5	34·0	36·2	37·4	24·0	43·2	43·5	37·9	38·5	24·0	1870	51·7	1833	27·7
31	38·2	33·7	47·7	31·0	28·9	37·5	39·9	23·3	36·5	44·5	44·5	38·0	23·3	1870	52·8	1859	29·5
Means	39·8	38·5	42·7	42·9	37·5	46·0	37·9	33·6	38·3	42·9	40·6	39·9	..	..	..	..	..

The mean temperature of the coldest day in December in sixty years was 18°·4, on the 24th day in the year 1830.

The mean temperature of the hottest day in December in sixty years was 56°·0, on the 7th day of the year 1856.

The difference between these numbers is 37°·6, and it represents the extreme difference between the mean temperature of two days in the month of December in sixty years.

The day of the month whose mean temperature has been subjected to the greatest difference, 39°·5, was the 25th; and that to the least, 23°·5, was the 3rd.

TABLE XIII.

Mean Temperature of every Day in the Year, as deduced from the Observations taken at the Royal Observatory, Greenwich, in the sixty years ending 1873.

Days of the Month.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December
	°	°	°	°	°	°	°	°	°	°	°	°
1	37·3	38·1	39·9	43·8	50·0	56·7	59·7	62·2	59·2	54·2	47·2	42·3
2	36·3	38·1	40·9	44·3	51·0	57·5	60·4	62·1	59·3	54·1	46·8	41·4
3	36·2	38·1	41·2	44·7	50·8	57·4	61·0	62·1	59·5	54·1	45·8	41·0
4	36·8	38·6	40·7	44·8	50·8	56·7	61·9	62·6	58·4	53·8	45·3	41·6
5	36·3	39·5	39·9	45·3	51·4	57·1	62·7	62·3	59·0	52·7	46·2	42·7
6	36·5	39·7	40·4	46·0	51·9	56·9	62·4	61·6	58·4	52·3	45·6	42·1
7	36·4	40·2	40·2	46·3	52·0	57·0	61·7	61·9	58·6	53·0	45·0	42·0
8	36·0	39·7	40·0	46·1	51·7	57·4	61·1	62·3	58·5	52·1	43·9	41·0
9	36·0	38·7	40·0	44·7	50·9	58·1	61·3	61·9	58·3	51·1	42·7	40·2
10	36·5	38·7	39·6	45·3	51·0	57·6	62·0	62·2	57·9	51·9	43·1	40·0
11	36·4	37·9	40·6	44·9	51·5	58·2	62·3	62·5	57·6	52·0	43·5	39·5
12	36·5	37·9	41·2	45·7	51·4	58·4	62·7	62·5	57·5	50·9	43·0	40·3
13	37·2	37·8	41·5	45·4	51·0	59·1	62·4	62·6	57·2	50·5	42·4	40·7
14	36·9	38·2	41·5	46·6	50·8	59·6	62·8	61·6	57·5	50·5	42·6	40·9
15	35·9	38·8	41·1	47·2	52·1	59·4	63·2	61·2	57·3	49·6	42·2	41·1
16	36·8	39·0	42·2	47·0	53·1	59·3	62·4	61·4	57·5	49·6	42·3	40·9
17	37·2	38·1	41·8	46·6	53·6	58·8	63·1	61·0	57·5	49·4	41·4	40·4
18	37·3	38·7	41·3	46·6	53·5	58·5	62·4	60·8	56·4	49·4	41·5	41·1
19	37·2	38·9	41·8	47·0	53·5	59·2	61·8	61·1	55·5	50·1	41·3	40·0
20	36·7	38·2	42·1	48·1	54·5	59·6	62·2	60·6	55·5	49·2	41·8	39·7
21	36·7	39·1	41·4	48·2	54·0	60·3	62·3	60·8	54·5	48·7	42·3	39·3
22	37·7	39·5	41·6	48·5	53·5	59·8	62·5	60·3	55·2	49·4	42·5	38·5
23	37·8	39·9	41·7	48·3	54·3	60·9	61·9	60·7	54·9	48·7	41·0	38·1
24	38·0	39·4	42·1	47·5	54·6	60·6	62·1	60·6	55·5	48·0	41·3	38·0
25	38·0	40·1	41·5	47·6	54·8	60·9	62·3	60·9	55·1	47·3	40·8	37·3
26	38·5	40·0	42·2	48·4	54·9	61·5	61·8	60·4	54·8	46·3	42·1	37·1
27	38·6	39·9	43·2	48·0	55·1	61·7	62·5	60·4	54·6	46·7	40·7	37·3
28	38·2	39·9	43·7	48·3	55·4	61·9	62·6	60·2	54·6	46·7	41·9	37·0
29	38·3	..	43·6	48·6	55·3	61·1	62·4	59·9	54·3	45·6	42·1	37·5
30	38·6	..	44·1	49·2	55·9	61·2	62·3	59·9	54·1	46·5	42·0	38·5
31	38·7	..	44·0	..	56·1	..	62·3	58·8	..	46·8	..	38·0
Means	37·1	39·0	41·5	46·6	52·9	59·1	62·1	61·3	56·8	50·1	43·0	39·9

The Mean for the Year = 49°·12.

From an inspection of Table XIV. it will be seen that during the portion of the year of increasing temperature, the sign (—) appears frequently, and that in the other portion the sign (+) also appears, but not so frequently: The most remarkable periods affected with successive (—) signs in the former portion, are February 8 to 13; March 4 to 10; May 7 to 14, and June 14 to 18—both days inclusive; and in the latter, the first instance of 8 consecutive (+) signs together is September 1 to 8; and there is another, November 20 to 22; there is a sequence of 4 (+) signs from December 12 to 15; and in no other case is there a sequence of more than two.

January.		February.		March.		April.		May.		June.		July.		August.		September.		October.		November.			
Between what days.	Diff. of Temp.	Date.	Diff. of Temp.	Date.	Diff. of Temp.	Date.	Diff. of Temp.	Date.	Diff. of Temp.	Date.	Diff. of Temp.	Date.	Diff. of Temp.	Date.	Diff. of Temp.	Date.	Diff. of Temp.	Date.	Diff. of Temp.	Date.	Diff. of Temp.	Date.	Diff. of Temp.
Dec. 31 &	°	Jan. 31 &	°	Feb. 28 &	°	Mar. 31 &	°	Apr. 30 &	°	May 31 &	°	June 30 &	°	July 31 &	°	Aug. 31 &	°	Sept. 30 &	°	Oct. 31 &	°	Nov. 30 &	°
1	−0·7	1	−0·6	1	0·0	1	−0·2	1	+0·8	1	−0·6	1	−1·5	1	−0·1	1	+0·4	1	+0·1	1	+0·4	1	+0·3
1 & 2	−1·0	2	0·0	2	+1·0	2	+0·5	2	+1·0	2	+0·8	2	+0·7	2	−0·1	2	+0·1	2	−0·1	2	−0·4	2	−0·9
2 & 3	−0·1	3	0·0	3	+0·3	3	+0·4	3	−0·2	3	−0·1	3	+0·6	3	0·0	3	+0·2	3	0·0	3	−1·0	3	−0·4
3 & 4	+0·6	4	+0·5	4	−0·5	4	+0·1	4	0·0	4	−0·7	4	+0·9	4	+0·5	4	−1·1	4	−0·3	4	−0·5	4	+0·6
4 & 5	−0·5	5	+0·9	5	−0·8	5	+0·5	5	+0·6	5	+0·4	5	+0·8	5	−0·3	5	+0·6	5	−1·1	5	+0·9	5	+1·1
5 & 6	+0·2	6	+0·2	6	+0·5	6	+0·7	6	+0·5	6	−0·2	6	−0·3	6	−0·7	6	−0·6	6	−0·4	6	−0·6	6	−0·6
6 & 7	−0·1	7	+0·5	7	−0·2	7	+0·3	7	+0·1	7	+0·1	7	−0·7	7	+0·3	7	+0·2	7	+0·7	7	−0·6	7	−0·1
7 & 8	−0·4	8	−0·5	8	−0·2	8	−0·2	8	−0·3	8	+0·4	8	−0·6	8	+0·4	8	−0·1	8	−0·9	8	−1·1	8	−1·0
8 & 9	+0·1	9	−1·0	9	0·0	9	−1·4	9	−0·8	9	+0·7	9	+0·2	9	−0·4	9	−0·2	9	−1·0	9	−1·2	9	−0·8
9 & 10	+0·4	10	0·0	10	−0·4	10	+0·9	10	+0·1	10	−0·5	10	+0·7	10	+0·3	10	−0·4	10	+0·8	10	+0·4	10	−0·2
10 & 11	−0·1	11	−0·8	11	+1·0	11	−0·4	11	+0·5	11	+0·6	11	+0·3	11	+0·3	11	−0·3	11	+0·1	11	+0·4	11	−0·5
11 & 12	+0·1	12	0·0	12	+0·6	12	+0·8	12	−0·1	12	+0·2	12	+0·4	12	0·0	12	−0·1	12	−1·1	12	−0·5	12	+0·8
12 & 13	+0·7	13	−0·1	13	+0·3	13	−0·3	13	−0·4	13	+0·7	13	−0·3	13	+0·1	13	−0·3	13	−0·4	13	−0·6	13	+0·4
13 & 14	−0·3	14	+0·4	14	0·0	14	+1·2	14	0·0	14	+0·5	14	+0·4	14	−1·0	14	+0·3	14	0·0	14	+0·2	14	+0·2
14 & 15	−1·0	15	+0·6	15	−0·4	15	+0·6	15	+1·1	15	−0·2	15	+0·4	15	−0·4	15	−0·2	15	−0·9	15	−0·4	15	+0·2
15 & 16	+0·9	16	+0·2	16	+1·1	16	−0·2	16	+1·0	16	−0·1	16	−0·8	16	+0·2	16	+0·2	16	0·0	16	+0·1	16	−0·2
16 & 17	+0·4	17	−0·9	17	−0·4	17	−0·4	17	+0·5	17	−0·5	17	+0·7	17	−0·4	17	0·0	17	−0·2	17	−0·9	17	−0·5
17 & 18	+0·1	18	+0·6	18	−0·5	18	0·0	18	−0·1	18	−0·3	18	−0·7	18	−0·2	18	−1·1	18	0·0	18	+0·1	18	+0·7
18 & 19	−0·1	19	+0·2	19	+0·5	19	+0·4	19	0·0	19	+0·7	19	−0·6	19	+0·3	19	−0·9	19	+0·7	19	−0·2	19	−1·1
19 & 20	−0·5	20	−0·7	20	+0·3	20	+1·1	20	+1·0	20	+0·4	20	+0·4	20	−0·5	20	0·0	20	−0·9	20	+0·5	20	−0·3
20 & 21	−0·1	21	+0·9	21	−0·7	21	+0·1	21	−0·5	21	+0·7	21	+0·1	21	+0·2	21	−1·0	21	−0·5	21	+0·5	21	−0·4
21 & 22	+1·1	22	+0·4	22	+0·2	22	+0·3	22	−0·5	22	−0·5	22	+0·2	22	−0·5	22	+0·7	22	+0·7	22	+0·2	22	−0·8
22 & 23	+0·1	23	+0·4	23	+0·1	23	−0·2	23	+0·8	23	+1·1	23	−0·6	23	+0·4	23	−0·3	23	−0·7	23	−1·5	23	−0·4
23 & 24	+0·2	24	−0·5	24	+0·4	24	−0·8	24	+0·3	24	−0·3	24	+0·2	24	−0·1	24	+0·6	24	−0·7	24	+0·3	24	−0·1
24 & 25	0·0	25	+0·7	25	−0·6	25	+0·1	25	+0·2	25	+0·3	25	+0·2	25	+0·3	25	−0·4	25	−0·7	25	−0·5	25	−0·7
25 & 26	+0·5	26	−0·1	26	+0·7	26	+0·8	26	+0·1	26	+0·6	26	−0·5	26	−0·5	26	−0·3	26	−1·0	26	+1·3	26	−0·2
26 & 27	+0·1	27	−0·1	27	+1·0	27	−0·4	27	+0·2	27	+0·2	27	+0·7	27	0·0	27	−0·2	27	+0·4	27	−1·4	27	+0·2
27 & 28	−0·4	28	0·0	28	+0·5	28	+0·3	28	+0·5	28	+0·2	28	+0·1	28	−0·2	28	0·0	28	0·0	28	+1·2	28	−0·3
28 & 29	+0·1	..	..	29	−0·1	29	+0·3	29	−0·3	29	−0·8	29	−0·2	29	−0·3	29	−0·3	29	−1·1	29	+0·2	29	+0·5
29 & 30	+0·3	..	..	30	+0·5	30	+0·6	30	+0·6	30	+0·1	30	−0·1	30	0·0	30	−0·2	30	+0·9	30	−0·1	30	+1·0
30 & 31	+0·1	..	..	31	−0·1	..	..	31	+0·2	..	..	31	0·0	31	−1·1	..	..	31	+0·3	..	..	31	−0·5

Mean for the Year = 0°·45.

It will also be seen that in every month differences appear as large as 1°, d in some months as large as 1°·5. By collecting together the numbers in able XIV. the following Table XV. was formed:—

TABLE XV.

Amount of Difference.	Number of Instances.												Year.
	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
°													
0·0	1	5	3	1	3	0	1	4	3	5	0	0	26
0·1	12	3	3	3	5	4	3	4	3	3	3	2	48
0·2	2	3	3	4	4	5	5	4	7	1	4	6	48
0·3	2	3	3	5	3	3	3	7	6	2	1	3	41
0·4	4	4	4	5	1	3	4	5	3	3	5	4	45
0·5	3	3	6	2	6	4	1	4	0	1	5	4	39
0·6	1	2	2	2	2	3	4	0	3	0	3	2	24
0·7	2	1	2	1	0	5	6	1	1	6	0	2	27
0·8	0	0	1	3	3	2	2	0	0	1	0	3	15
0·9	1	3	0	1	0	0	1	0	1	4	2	1	14
1·0	2	1	3	0	3	0	0	1	1	2	1	2	16
1·1	1	0	1	1	1	1	0	1	2	3	1	2	14
1·2	0	0	0	1	0	0	0	0	0	0	2	0	3
1·3	0	0	0	0	0	0	0	0	0	0	1	0	1
1·4	0	0	0	1	0	0	0	0	0	0	1	0	2
1·5	0	0	0	0	0	0	1	0	0	0	1	0	2
Sums ...	31	28	31	30	31	30	31	31	30	31	30	31	365

From Table XV. we learn that in three months, viz. June, November and December, the temperature of no two consecutive days is alike; that in each of the months of January, April and July, there is one instance of the same mean temperature on two consecutive days; that in March, May and September, there are three such instances in each month; that there are four in August, and five in February and October, viz. 26 instances in the year. In the year there are 48 instances in which the differences amount to 0°·1, of which ¼th part or 12 are in January; there are 48 instances of 0°·2, which are nearly equally distributed over the year; 41 of 0° 3; 45 of 0°·4; 39 of 0°·5; 24 of 0°·6; 27 of 0°·7; 15 of 0°·8; 14 of 0°·9; 16 of 1°·0; 14 of 1°·1; and 8 of 1°·2, or greater than 1°·2; of these, two, viz. June 30 to July 1, and November 22 to 23, are as large as 1°·5; and two, viz. April 8 to 9, and November 26 to 27, amount each to 1°·4. In November there are 7 instances of which the difference of temperature between two consecutive days amounts to or exceeds 1°·0.

With so many large differences remaining after 60 years, it is evident that a very long series of observations would be needed before the mean temperature would proceed progressively. It becomes a matter of a good deal of interest, however, to examine in some detail to what extent the large differences that originally appeared in the 48 years' results have been affected by the addition of 17 years' observations.

The results are shown in Table XVI., the first division containing instances

TABLE XVI.

Instances when the difference was less by 0°·4, or a greater decrease, by 17 years' additional observations.			
Month and Day.	43 Years.	50 Years.	60 Years.
	°	°	°
January 3 and 4	+1·0	+0·6	+0·6
,, 4 ,, 5	−0·9	−0·9	−0·5
,, 7 ,, 8	−1·3	−0·6	−0·4
,, 15 ,, 16	+1·3	+0·9	+0·9
,, 25 ,, 26	+1·1	+0·6	+0·5
February 6 ,, 7	+1·3	+0·7	+0·5
March 3 ,, 4	−1·1	−0·9	−0·5
,, 25 ,, 26	+1·1	+0·9	+0·7
May 22 ,, 23	+1·2	+1·3	+0·8
,, 30 ,, 31	+1·1	+0·6	+0·2
June 10 ,, 11	+1·0	+1·0	+0·6
October 11 ,, 12	−1·5	−1·3	−1·1
,, 24 ,, 25	−1·1	−0·7	−0·7
,, 26 ,, 27	+1·0	+0·7	+0·4
,, 28 ,, 29	−1·5	−1·8	−1·1
November 3 ,, 4	−1·0	−0·5	−0·5
,, 7 ,, 8	−1·6	−1·6	−1·1
,, 9 ,, 10	+1·4	+1·0	+0·4
,, 12 ,, 13	−1·1	−1·0	−0·6
,, 24 ,, 25	−1·0	−0·4	−0·5
,, 27 ,, 28	+2·0	+1·6	+1·2
December 2 ,, 3	−1·0	−1·0	−0·4
,, 5 ,, 6	−1·1	−1·1	−0·6
,, 10 ,, 11	−1·2	−1·0	−0·5
,, 29 ,, 30	+1·8	+1·7	+1·0
Means	1·2	1·0	0·7

Instances when the difference was less by 0°·3, or a less decrease, by 17 years' additional observations.			
Month and Day.	43 Years.	50 Years.	60 Years.
	°	°	°
January 14 and 15	−1·3	−1·0	−1·0
February 4 ,, 5	+1·0	+1·1	+0·9
,, 20 ,, 21	+1·0	+1·0	+0·9
,, 24 ,, 25	+1·0	+0·7	+0·7
March 26 ,, 27	+1·3	+1·2	+1·0
April 13 ,, 14	+1·4	+1·3	+1·2
,, 19 ,, 20	+1·4	+1·3	+1·1
,, 25 ,, 26	+1·0	+0·7	+0·8
May 1 ,, 2	+1·2	+1·2	+1·0
,, 8 ,, 9	−1·1	−0·8	−0·8
,, 14 ,, 15	+1·3	+1·4	+1·1
,, 15 ,, 16	+1·2	+1·2	+1·0
,, 19 ,, 20	+1·0	+1·1	+0·9
June 3 ,, 4	−1·0	−0·8	−0·7
,, 22 ,, 23	+1·4	+1·4	+1·1
,, 28 ,, 29	−0·9	−0·9	−0·8
,, 30 ,, July 1	−1·8	−1·6	−1·5
July 3 ,, 4	+1·0	+0·9	+0·9
August 30 ,, 31	−1·4	−1·3	−1·1
September 3 ,, 4	−1·4	−1·4	−1·1
,, 18 ,, 19	−1·0	−0·8	−0·9
October 7 ,, 8	−1·0	−1·0	−0·9
,, 14 ,, 15	−1·0	−1·0	−0·9
,, 25 ,, 26	−1·3	−1·2	−1·0
,, 29 ,, 30	+1·2	+1·0	+0·9
November 2 ,, 3	−1·2	−1·0	−1·0
,, 4 ,, 5	+1·0	+0·9	+0·9
,, 22 ,, 23	−1·6	−1·8	−1·5
Means	1·2	1·1	0·9

Instances when the difference remained the same, or was greater by 17 years' additional observations.			
Month and Day.	43 Years.	50 Years.	60 Years.
	°	°	°
January 1 and 2	−1·0	−1·4	−1·0
,, 21 ,, 22	+0·9	+1·0	+1·1
February 8 ,, 9	−0·6	−0·7	−1·0
,, 16 ,, 17	−0·2	−0·9	−0·9
,, 19 ,, 20	−0·7	−0·6	−0·7
March 1 ,, 2	+1·0	+0·8	+1·0
,, 10 ,, 11	+0·9	+0·8	+1·0
,, 15 ,, 16	+0·8	+0·9	+1·1
,, 20 ,, 21	−0·5	−0·9	−0·7
April 8 ,, 9	−1·2	−1·3	−1·4
July 15 ,, 16	−0·7	−1·1	−0·8
August 13 ,, 14	−0·8	−1·1	−1·0
September 17 ,, 18	−1·0	−1·2	−1·1
,, 20 ,, 21	−1·0	−1·1	−1·0
October 4 ,, 5	−1·1	−1·4	−1·1
,, 8 ,, 9	−0·7	−0·9	−1·0
November 8 ,, 9	−0·9	−1·0	−1·2
,, 16 ,, 17	−0·5	−0·6	−0·9
,, 25 ,, 26	+0·6	+1·0	+1·3
,, 26 ,, 27	−0·9	−1·1	−1·4
December 4 ,, 5	+1·0	+1·2	+1·1
,, 7 ,, 8	−0·6	−0·8	−1·0
,, 18 ,, 19	−1·1	−1·0	−1·1
Means	0·8	1·0	1·0

in which the differences found in 43 years' observations have decreased by 0°·4 at least by the addition of 17 years; the second division, those in which they have decreased by 0°·3 at most; and the third division, those in which the differences have remained unchanged or have increased.

From the first division in Table XVI. we see there are 25 instances where the average difference between the mean temperature of two consecutive days from 43 years' observations was 1°·2, decreasing by 7 additional years' observations to 1°·0; and still further decreasing to 0°·7 from 60 years' observations; in the second division there are 28 instances where the average difference between the mean temperature from 43 years' observations was 1°·2, decreasing after 7 additional years to 1° 1, and by the addition of 10 years more to 0°·9. But in the third division there are no less than 23 instances where the average difference of temperature of two consecutive days was 0°·8 after 43 years' observations, increasing to 1°·0 from 50 years, and remaining the same, viz. 1°·0, after 60 years' observations. Some of these are remarkable—for instance, between the 8th and 9th days of April, from 43 years' observations the difference was 1°·2, after 50 years was 1°·3, and after 60 years it is 1°·4.

It appears, therefore, that there are 53 cases in which the difference has decreased, and 23 where it has increased by the longer series of observations. Upon the whole, there is a gradual tendency towards uniformity; but the improvement is slow, and from the number of cases of increase in the large differences, we may infer that it would take a great many years of additional observations before the results would flow in a continuous curve. Indeed, it is all but certain that before such would be the case, the amount of change in the climate, continually progressing, would alter the general form of the curve, and if so, it is possible that a much greater number of years than that now used could not be combined with advantage.

This point is I think important, and the results are, speaking generally, what we should be inclined to expect. If from the 43 years' observations we have for any two consecutive days a mean difference of α, the most probable value of this difference after the addition of 17 years' more observations is $\frac{43}{60}\alpha$, and if β denote the difference as derived from the 17 years' observations, then if β be after the same sign as α and greater than α, which is clearly a case which may well occur, the difference is increased. Of course this merely amounts to noting how slow is the progress towards the truth of results obtained as means, after a certain point, unless the additional observations be much larger than those already employed, viz. given the means of n observation, we do not improve matters greatly by the addition of m additional observations, unless m is large relatively to n. From what has gone before we see that although on the whole we have, as we ought to have, an improvement, yet this is not very marked.

The change in the character of the climate, as shown by a comparison of the years near the beginning and near the end of the period considered, is decided, and as intimated above, it is questionable whether the increased continuity gained by including future observations, will really be an additional advance towards the object in view.

In Table XVII. it will be seen that the coldest days in the year on the average are January 8 and 9; the temperature then slowly increases from its lowest 36°·2, at the rate of about 0°·1 per day, to 39°·1 on February 6, and remains at this value till the 9th; the increase is here checked,

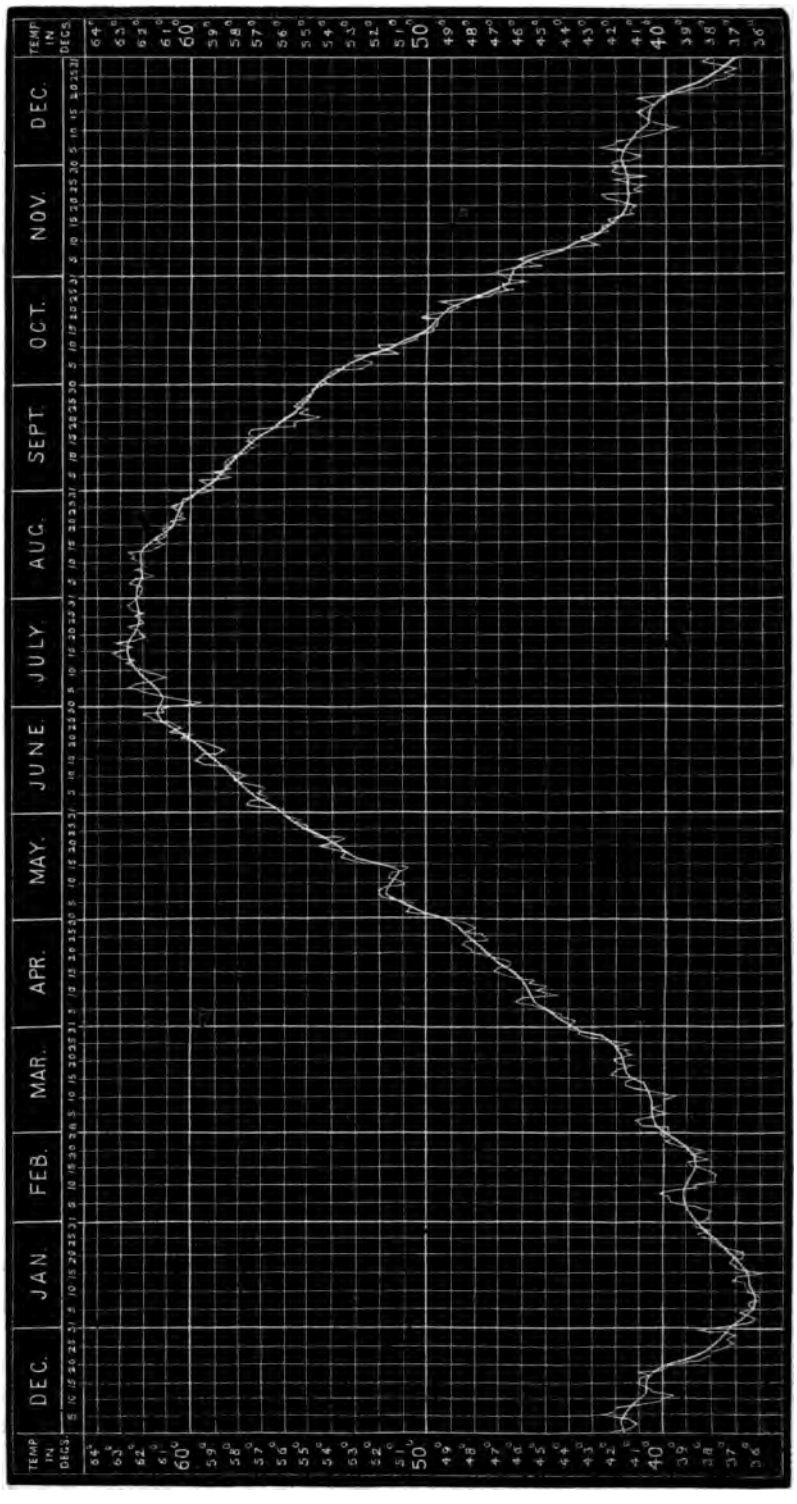
TABLE XVII.

Showing the adopted Mean Temperature of every day in the year, as determined from all the Thermometrical Observations taken at the Royal Observatory, Greenwich, in the years 1814 to 1873 (inclusive).

Days of the Month.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	°	°	°	°	°	°	°	°	°	°	°	°
1	37·2	38·6	40·3	44·2	49·8	56·5	61·2	62·3	59·4	54·4	46·2	41·7
2	36·9	38·7	40·4	44·4	50·1	56·7	61·1	62·3	59·3	54·2	46·0	41·8
3	36·7	38·8	40·5	44·6	50·4	56·9	61·2	62·2	59·1	53·9	45·8	41·8
4	36·6	38·9	40·5	44·8	50·8	57·1	61·3	62·2	58·8	53·5	45·6	41·8
5	36·5	39·0	40·5	44·9	51·2	57·3	61·5	62·1	58·6	53·2	45·4	41·7
6	36·4	39·1	40·5	45·0	51·6	57·5	61·6	62·1	58·4	52·9	45·1	41·6
7	36·3	39·1	40·5	45·2	51·7	57·6	61·8	62·0	58·4	52·6	44·7	41·5
8	36·2	39·1	40·5	45·4	51·6	57·7	62·0	62·0	58·3	52·2	44·3	41·4
9	36·2	39·1	40·5	45·6	51·5	57·9	62·1	62·1	58·1	51·9	43·9	41·2
10	36·3	39·0	40·6	45·7	51·3	58·1	62·2	62·1	58·0	51·6	43·5	41·0
11	36·3	39·0	40·7	45·8	51·2	58·3	62·3	62·2	57·8	51·3	43·2	40·8
12	36·4	38·9	40·8	45·9	51·1	58·5	62·4	62·2	57·6	51·0	42·9	40·7
13	36·4	38·9	41·0	46·1	51·1	58·7	62·5	62·2	57·4	50·7	42·7	40·6
14	36·5	38·8	41·2	46·3	51·3	58·9	62·6	62·0	57·2	50·4	42·5	40·7
15	36·6	38·7	41·4	46·5	51·7	59·0	62·7	61·7	57·1	50·2	42·3	40·7
16	36·7	38·7	41·5	46·6	52·3	59·1	62·7	61·4	56·9	50·0	42·2	40·7
17	36·8	38·7	41·6	46·8	52·8	59·3	62·7	61·2	56·6	49·8	42·0	40·5
18	36·9	38·8	41·7	47·0	53·2	59·5	62·6	61·0	56·4	49·7	41·9	40·2
19	37·0	38·8	41·7	47·2	53·6	59·7	62·5	60·9	56·1	49·5	41·8	40·0
20	37·2	38·9	41·7	47·4	53·7	59·9	62·4	60·8	55·8	49·3	41·7	39·7
21	37·3	39·0	41·8	47·6	53·9	60·1	62·3	60·7	55·5	49·0	41·7	39·3
22	37·4	39·1	41·9	47·8	54·1	60·4	62·3	60·7	55·3	48·7	41·7	38·8
23	37·5	39·2	42·0	48·0	54·3	60·7	62·2	60·7	55·2	48·3	41·7	38·4
24	37·7	39·3	42·1	48·2	54·6	60·9	62·2	60·6	55·0	47·9	41·6	38·2
25	37·8	39·5	42·3	48·3	55·0	61·1	62·2	60·5	54·8	47·5	41·6	38·0
26	37·9	39·7	42·5	48·5	55·2	61·2	62·2	60·4	54·7	47·2	41·6	37·8
27	38·1	39·9	42·7	48·7	55·4	61·3	62·2	60·3	54·6	46·9	41·6	37·6
28	38·2	40·1	43·0	48·9	55·6	61·3	62·2	60·2	54·5	46·7	41·6	37·5
29	38·3	..	43·3	49·1	55·8	61·3	62·3	60·1	54·4	46·6	41·7	37·4
30	38·4	..	43·7	49·4	56·0	61·2	62·3	60·0	54·3	46·5	41·7	37·3
31	38·5	..	44·0	..	56·3	..	62·3	59·8	..	46·4	..	37·2
Means	37·1	39·0	41·5	46·6	52·9	59·1	62·1	61·3	56·8	50·1	43·0	39·9

The Mean for the Year = 49°·12.

and a decrease of about 0°·07 per day for 6 days takes place to 38°·7 on the 15th; from the 17th it increases at the rate of about 0°·12 per day to 40°·5 by the 3rd of March; is stationary at 40°·5 till the 9th day, then slowly increases to 42°·1 by the 24th, and increases more quickly to 44°·8 by April 4; the rate of increase is then slower for several days, but proceeds more quickly from the 17th, viz. at about the rate of



Mean Temperature of the Air for every Day in the Year (from January 1st, 1814, to December 31st, 1873) at the Royal Observatory, Greenwich.

0°·2 per day; and still more rapidly at the end of April and beginning of May, at the rate of 0°·8 or 0°·4 per day, to 51°·6 on the 6th May. The rate of increase is here suddenly checked, and the temperature declines day by day to 51°·1 by the 12th and 13th. From the 14th of May a steady increase sets in, and continues at the rate of something more than 0°·2 per day to 61°·8 near the end of June, when a slight decline takes place, the temperature at the beginning of July being a little lower than at the end of June, it then slowly increases to the hottest days in the year, viz. 62°·7 on July 15 to 17. From this time to the middle of August the changes of temperature are very small, and the decrease of temperature from the maximum to the 16th of August is less than 1°·5. A quicker decline of temperature then takes places, and continues with very slight checks to 42°·3 about the middle of November, thence to the 6th of December the temperature undergoes very little change, but it then declines to 37°·2 at the end of the year, and to the minimum temperature on January 8 and 9.

The several checks to continuous increase of temperature whilst passing

TABLE XVIII.

Showing the Distribution of Heat over the year, the Mean Temperature of the year being represented by unity.

Days of the Month.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1	0·758	0·786	0·821	0·900	1·014	1·151	1·247	1·269	1·212	1·108	0·941	0·849
2	0·752	0·788	0·823	0·906	1·021	1·155	1·244	1·269	1·208	1·104	0·937	0·851
3	0·747	0·790	0·825	0·912	1·026	1·159	1·247	1·267	1·204	1·098	0·933	0·851
4	0·745	0·792	0·825	0·916	1·035	1·163	1·249	1·267	1·198	1·092	0·929	0·851
5	0·743	0·794	0·825	0·921	1·043	1·167	1·253	1·265	1·194	1·084	0·925	0·849
6	0·741	0·796	0·825	0·923	1·051	1·171	1·255	1·265	1·190	1·077	0·919	0·847
7	0·739	0·796	0·825	0·925	1·053	1·173	1·259	1·263	1·190	1·071	0·910	0·845
8	0·737	0·796	0·825	0·927	1·051	1·175	1·263	1·263	1·187	1·063	0·903	0·843
9	0·737	0·796	0·825	0·929	1·049	1·180	1·265	1·265	1·183	1·057	0·894	0·839
10	0·739	0·794	0·827	0·931	1·045	1·183	1·267	1·265	1·181	1·051	0·886	0·835
11	0·740	0·794	0·829	0·933	1·043	1·187	1·269	1·267	1·177	1·045	0·880	0·831
12	0·741	0·792	0·831	0·935	1·041	1·191	1·271	1·267	1·173	1·039	0·874	0·829
13	0·741	0·792	0·835	0·937	1·041	1·196	1·273	1·267	1·169	1·033	0·870	0·827
14	0·743	0·790	0·839	0·941	1·045	1·200	1·275	1·263	1·165	1·027	0·866	0·829
15	0·745	0·788	0·843	0·945	1·053	1·202	1·277	1·257	1·163	1·023	0·862	0·829
16	0·747	0·788	0·845	0·949	1·065	1·204	1·277	1·251	1·159	1·018	0·859	0·829
17	0·749	0·788	0·847	0·953	1·075	1·208	1·277	1·247	1·153	1·014	0·855	0·825
18	0·752	0·790	0·849	0·957	1·083	1·212	1·275	1·242	1·149	1·012	0·853	0·819
19	0·754	0·790	0·849	0·961	1·092	1·216	1·273	1·240	1·143	1·008	0·851	0·815
20	0·758	0·792	0·849	0·965	1·094	1·220	1·271	1·238	1·136	1·004	0·849	0·809
21	0·760	0·794	0·851	0·970	1·098	1·224	1·269	1·236	1·130	0·998	0·849	0·800
22	0·762	0·796	0·853	0·974	1·102	1·230	1·269	1·236	1·126	0·992	0·849	0·790
23	0·764	0·798	0·855	0·978	1·106	1·236	1·267	1·236	1·124	0·984	0·849	0·782
24	0·768	0·800	0·857	0·982	1·112	1·240	1·267	1·234	1·120	0·976	0·847	0·778
25	0·770	0·804	0·862	0·984	1·120	1·244	1·267	1·232	1·116	0·968	0·847	0·774
26	0·772	0·809	0·866	0·986	1·124	1·247	1·267	1·230	1·114	0·961	0·847	0·770
27	0·776	0·813	0·870	0·990	1·128	1·249	1·267	1·228	1·112	0·955	0·847	0·766
28	0·778	0·817	0·876	0·994	1·132	1·249	1·267	1·226	1·110	0·951	0·847	0·764
29	0·780	..	0·882	1·000	1·136	1·249	1·269	1·224	1·108	0·949	0·849	0·762
30	0·782	..	0·890	1·006	1·141	1·247	1·269	1·222	1·106	0·947	0·849	0·760
31	0·784	..	0·896	..	1·147	..	1·269	1·218	..	0·945	..	0·758

from the minimum in January to the maximum temperature of the year in July, are remarkable; the declining instead of increasing temperature in February, is possibly relative only; it is probably due to the great increase at the end of January and beginning of February. The decline about the 10th of March and 10th of April are both preceded by rather high temperatures, as is that at the end of June. The most remarkable check is that in May; it seems probable that this represents a physical fact due to some astronomical or other cause. The declining branch of the curve from the period of maximum to minimum temperatures is much more decided, and the checks to its decline are very much less than in the ascending branch till the middle of November, when the check is very remarkable indeed, as for nearly three weeks the temperature is almost constant, when the decline again sets in, and continues till the minimum is reached in January.

In Table XVIII. the mean temperature of the year being represented by 1·000, we see that the mean temperature of April 29 is the same as that of the year. For no other day is the mean temperature denoted exactly by 1·000, but for October 21 it is 0·998, differing so little that we may consider this as the second day of mean temperature; the smallest numbers in the table 0·787 appear on January 8 and 9, and the largest 1·277 on July 15, 16 and 17. Assuming the day of lowest temperature to be January 8½, and that of the highest to be July 16, the number of days from the lowest temperature till the mean of the year is reached is 110½; from the mean to the highest 78; from the highest to the second day of mean temperature 97; and from this day to the lowest 79½. Leaving out of consideration April 29 and October 21, as being equal to the mean, there are 176 days in the year which are above the mean annual temperature, and 187 which are below it. The number of days during which the temperature is increasing from its lowest value, January 8 and 9, to its highest value July 16, is 188½, and the number of days from the highest value to the lowest is 176½. So that the gradual rise of the temperature in the year occupies 12 days more than does the decline.

DISCUSSION.

Dr. TRIPE said that the Society must feel much indebted to Mr. Glaisher for his Paper, but as regards the Table of Mean Temperature, he thought that the object for which observations are taken is not merely to obtain a mean, but to ascertain if there has been at different periods any marked departure from the average. He considered that short periods were better for comparison than long ones, and that, therefore, the curve for 10 years would be better if it stood alone than when combined with the previous 50 years. As Mr. Glaisher himself pointed out, a true mean has not yet been obtained, and, therefore, it would be more useful to have the means of 10 or 20 year periods.

Mr. PARK HARRISON said, that he had occasion to make use of the first series of Daily Mean Temperatures (for 43 years) soon after they were published, and found them to be of extremely unequal value; the only means absolutely to be relied on being those that were derived from the bi-horary observations taken in 1840-47. The system of correcting temperatures for daily range by uniform quantities for four successive weeks, and then abruptly changing the amount of the correction to twice the quantity for the next four weeks, &c. appeared to him to be indefensible:—This, apart from the entire insufficiency of the basis on which the system was formed. He could not understand why Mr. Glaisher should not have

made use of the photographic traces, at any rate, say, for 3 hours of the night. If this had been done, he had no hesitation in saying that many of the daily means in these tables would have been found to be incorrect by more than 2°. The Astronomer Royal in a late Report had recognised the fact that the system so long followed at Greenwich was erroneous; and he (Mr. Harrison) trusted that before long a corrected series of daily means would be issued.

Mr. SYMONS said that he was not an advocate for the use of corrections for diurnal range, but he thought that the Greenwich ones were applicable not only to observations at Greenwich but throughout the Home Counties and in the watershed of the river Thames. He was not sure that it was desirable to work with long periods of observations; he himself had worked with decades, as he considered them preferable to long periods, better suited for comparison and, after all, could be combined as required.

Mr. MARRIOTT said that it was evident that the corrections for diurnal range mentioned in the paper could not have been used for the whole of the period, as they were not published till 1867. Those Tables had not been adopted at all at the Royal Observatory, but the observations were corrected by the factors given in Table IV. of Mr. Glaisher's Paper in "Phil. Trans." No mention had been made in this or the two previous papers of the position and exposure of the thermometers employed. In the "Greenwich Observations" for 1846, it was stated that "a post was planted in the year 1841 in the north-east re-entering angle of the Magnetic Observatory, about six feet from the walls of the building, and upon this a revolving frame was placed for carrying the thermometers. The post remained in this position till 1846, July 20th, and on July 22nd it was planted in a position 23 feet south of the south-east angle of the south arm of the Magnetic Observatory." It continued in this position till 1863, when it was moved 12 feet further south. He did not consider it fair to combine the whole 60 years' observations together, as they had not been made on the same plan, there having been no less than seven different series of observations. The maximum and minimum observations prior to 1841 were also so discordant that they had to be rejected, consequently the observations up to that time must have been corrected by certain arbitrary values, quite independent of the daily range of temperature. He had extracted from the "Greenwich Observations" the monthly mean maximum and minimum temperatures from 1848 to 1872, to see if there had been any change in climate during that period. This interval had been selected, as it could be broken up into five periods of five years each, and as the observations had been taken on the same plan throughout.

The following are the means for the five-yearly periods:—

Years.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Means.
	°	°	°	°	°	°	°	°	°	°	°	°	°
1848-52	38·6	42·7	42·4	47·0	54·2	59·4	63·5	62·4	57·8	50·4	44·3	41·9	50·4
1853-57	38·7	37·3	41·1	47·8	52·5	59·6	63·4	64·0	58·2	52·3	42·5	39·3	49·7
1858-62	38·2	40·0	44·2	47·1	54·6	61·2	63·1	62·9	58·3	52·9	40·9	39·6	50·3
1863-67	38·2	40·4	40·9	50·7	54·3	60·7	62·7	61·9	59·0	51·4	43·6	40·5	50·4
1868-72	38·3	42·8	43·0	50·1	54·1	60·1	66·3	63·8	59·3	49·6	42·1	39·6	50·6
Mean..	38·4	40·6	42·3	48·6	54·0	60·2	63·8	63·0	58·5	51·3	42·7	40·1	50·3

The year 1855 being remarkably cold, has reduced the mean for the second period, while the year 1868, being very warm, has increased the last period, otherwise there appears to have been little, if any, change, in temperature during the 25 years.

Mr. NASH said that, within his experience, the position of the thermometer stand at the Royal Observatory had been slightly changed two or three times in order to obtain better exposure. He thought that too much reliance ought not to be placed upon the results deduced from the observations made prior to the year 1840, as although

the observations had been for the most part carefully made (he believed by Mr. Belville principally), yet they were scanty, and had not been made regularly. The diurnal range corrections in use at the Royal Observatory were those derived by the use of the factors given in Table IV. of Mr. Glaisher's paper, "Phil. Trans." 1848, as had been stated by Mr. Marriott, and corrections as derived by this process had been systematically employed in the reduction of the observations since the year 1854. He agreed with the preceding speakers that long periods of observation were not necessary for the deduction of valuable results, and considered that had Mr. Glaisher confined his investigation to the observations made since the establishment of a regular system in 1840, better and smoother results might have been obtained.

XVIII. *On the Meteorology of Mozufferpore, Tirhoot, for* 1875. By C. N. Pearson, F.M.S.

[Received March 18th.—Read May 17th, 1876.]

Tirhoot is a district of North Behar, situated in about N lat. 25°, consequently it is just out of the tropics. It has a decidedly continental climate, as will be evident from the great range of temperature between the hot and cold months, as also between day and night during the winter and spring months.

The year may be said to be capable of division into three marked seasons, viz. the hot season, from about 15th of March to the 15th June; the rainy season, extending from 15th June to October; and the cold season, beginning about the 15th October and lasting till March.

The climate may be held to be strictly tropical only during the rainy season, when the range of temperature is small, extending in average years between 75° and 90°.

The rainfall of the district may be taken to be about 50 inches, on an average of years; but it is very irregular, as will be seen by a comparison of the rainfall of the last six years—

1870	...	...	...	...	...	79·78	inches.
1871	...	...	...	...	...	84·21	,,
1872	...	...	...	...	...	52·50	,,
1873	...	...	...	...	...	29·03	,,
1874	...	...	...	...	...	43·27	,,
1875	...	...	...	...	...	36·58	,,

It may be noted parenthetically, that the abnormally small rainfall of 1873, coupled with the very early cessation of the rains that year, was the cause of a famine, felt very severely in these parts in consequence of the loss of the rice harvest from drought. The small rainfall of 1875 also caused local scarcity.

The general directions of the wind are a compound of the West from October to March, and a compound of the East during the rest of the year. North and South winds are very rare. The East wind is in reality the SW monsoon, which, after passing up the Bay of Bengal, and over Lower Bengal as a S wind, impinges upon the Himalayah mountains, and is by them turned

out of its course, and passes along the valley of the Ganges as an East wind. It is this wind that ushers in the rainy season, and blows during its continuance. Its characteristics are, as may be supposed, heat and damp. The West wind is of an opposite character to the above—it is essentially dry and bracing; during the cold months it gives fine clear weather, with cold nights, and occasionally in January even white frost. From March to May when it blows, it is termed "the hot wind;" it raises the temperature by day to from 95° to 105°, and is extremely dry and hot, causing furniture to crack and books to warp; it never blows at night, and frequently after a hot wind the temperature at night will fall to 60° or thereabouts, with a calm and serene atmosphere.

The contest during the hot season between this wind and the damp East wind of the approaching monsoon, gives rise to storms called "North Westers," owing to their rising in the North West quarter of the heavens. The storm is at first accompanied by clouds of dust, which sometimes make it almost dark at midday, and is frequently followed by heavy rain, sometimes hail, and always by thunder and lightning of great severity at times.

The year 1875 was in some respects abnormal: January gave a rather severe thunder and hail storm on the evening of the 4th, an unusual occurrence at that season. White frosts occurred on the 22nd, 23rd, 24th, 28th, and 29th. February, March and April were seasonable. May was cooler than usual, and distinguished by several severe North Westers; that of the 16th was especially violent. June was very hot, and the monsoon was rather late in setting in. The last week, between the 20th and 26th, gave 16 inches of rain at Hajipore, a place only 34 miles south of this, whereas here the rainfall was only 3·67 inches, and at Sitamurhi, about 35 miles north of this, it did not exceed 1½ inch. This is an instance of the extreme uncertainty of the rainfall, even at places near each other. This is much more evident in India than in England, owing probably to violent local thunder showers there. July was extremely hot, and in many places scarcely a shower fell between the 6th and 27th; this in July, usually the most rainy month of the monsoon, is very unusual. August and September were seasonable. Though these months are distinguished in many parts of India by heavy rainfall and severe floods, the rain was here about the average in August, and considerably below it in September. The rainy season ceased abruptly on the 26th September, and at this place not another shower fell to the end of the year. The same was the case throughout the whole of Behar and at a great many places in Bengal. There were indeed local thunder showers on the 16th and 23rd October, but they were extremely partial.

One of the most remarkable features of the year 1875 was the extremely unequal distribution of its rainfall, places within short distances of each other exhibiting extraordinary discrepancies.

Hajipore	...	...	...	...	...	56·26 inches
Mozufferpore	...	...	...	...		36·58 ,,
Durbhunga	...	...	...	...	...	48·57 ,,
Sitamurhi	...	...	...	...	...	26·07 ,,

Of the above stations, starting from this place (Mozufferpore), Hajipore lies 84 miles south on the banks of the Ganges, whilst Sitamurhi is about the same distance in the opposite direction towards the Himalayah mountains. Durbhunga is also about 84 miles distant in an easterly direction. This year Hajipore on the Ganges had no less than 30·19 inches more rain than Sitamurhi, chiefly owing to the extraordinary local fall there between the 20th and 26th June above alluded to. It may be stated that the general course of the monsoon rains is to fall in greater abundance in the sub-Himalayan tract of country in which Sitamurhi is situated. This year the usual course was reversed, and the valley of the Ganges received abundant rains which indeed extended with violence into the north-western provinces, and even to the southern Punjab: at Delhi 37 inches of rain fell between the 5th and 11th September, being no less than 10·93 inches in one week more than fell at Sitamurhi throughout the year, and 0·42 inches more than fell at Mozufferpore. The consequence of this great local rainfall was, as may be imagined, violent floods in those provinces; the Ganges had one of the highest floods yet known, and other rivers were proportionally high, whereas in the sub-Himalayan tracts, notably Dinagepore, Purneah, Modhoobani, and Sitamurhi, the lightness of the rains and their early cessation caused a failure of the rice crop, amounting locally to $\frac{7}{8}$ths of the crop. The extremely limited area of this failure in the staple crop has prevented its assuming anything like the proportions of the famine of 1873-74, when the failure was general throughout Behar. In Calcutta the rainfall was 59 inches in the year, being about 8 inches below the average, and the rice crop one of the best ever known.

One thing will strike English observers as remarkable, and that is, the range of the barometer as compared with English observations.* As a guide, indeed, to coming rain the barometer in India may be said to be worthless, except indeed in case of the approach of a cyclone. The barometer ranges low during the monsoon months, averaging about 29·55 inches, and in the cold season it ranges about 0·3 inches higher; but there is no perceptible depression before heavy falls of rain, or before storms, as in England.

I may state in conclusion that my self-registering thermometer is one of Negretti and Zambra's, and is placed on the north side of the house, at an elevation of about 5 feet from the ground. The rain gauge also is by the same makers. The barometer is an aneroid, and an instrument which I have always found very accurate. I have not a standard barometer with me.

*This paper was accompanied by Tables of Daily Observations of the Barometer Temperature, Wind, Rain and Weather, which have been deposited in the Library for reference.

XIX. *The Climate of Scarborough.* By Francis Shaw, F.M.S.

[Received April 8th.—Read June 21st, 1876.]

Before proceeding to offer some remarks on the mean values of the different meteorological elements in the following Table, it may perhaps be well to say a few words on the position of the instruments, and of the town itself. Scarborough is situated in lat. 54° 17′ N long. 0° 23′ W, in the recess of a fine bay on the north-east coast of England, and contains a resident population, estimated up to the present time, of about 27,000. It is bounded on the east by the German Ocean, and on the south by a steep hill (Oliver's Mount), the summit of which is 500 feet above the sea at one mile from the town. A valley runs out to the south-west, from which point to the north-west ranges of hills extend, rising somewhat irregularly from the town till, at a distance of from two to three miles, they attain an elevation of 600 feet above the sea level. To the north the country is more open and even.

The instruments were all supplied by the Meteorological Office, and have been verified at Kew. They were placed during the whole of the period in a louvre-boarded case, and fixed to the side of a stout wooden structure used as a photographic gallery, having an open grass-plot in front of them, with a north aspect. The garden is about mid-way between the north and south sides of the town, and 150 yards from the shore ; and as both residents and visitors are continually passing to and fro along this line, the thermometer observations may, I think, very fairly represent the correct temperature of Scarborough as a watering place.

The instruments are 115 feet above sea level, and 4 feet above the ground. The rain gauge (8in. diameter) is 130 feet above the sea, and its rim one foot above the ground. The whole of the instruments are annually inspected by the Director of the Meteorological Office. I may add that at the commencement of the present year the thermometers were placed in a Stevenson screen in the middle of the garden, 40 feet from the wall screen ; and a careful comparison between the two situations made in January and February showed that out of an average of 46 and 48 observations respectively, the instrument in the 'Stevenson' read only 0°·15 for the former month, and 0°·19 for the latter, higher than that in the wall screen.

The mean temperature has been deduced from the daily maximum and minimum readings, without the application of any other corrections than those for the scale errors of the instruments.

The temperature observations are derived from an average of the last eight years, viz. 1868 to 1875 inclusive ; the rainfall is from a ten-years' average (1866-1875) ; and the wind direction is the result of a five-years' average, also ending with 1875.

The maximum temperature on any day in July—the warmest month—does not exceed on the average 78°·0, the highest in the eight years being 85°·5, which occurred in 1868.

Average Temperature, Rainfall, and Direction of the Wind at Scarborough.

Months.	Temperature (in shade).							Rainfall.		Wind.				
	Average of Extreme Max.	Average of Extreme Min.	Monthly Range.	Day.	Night.	Daily Range.	Mean Temp.	Amount.	No. of Days it fell.	Relative proportion of.				Mean Direction (nearly).
										N.	E.	S.	W.	
	°	°	°	°	°	°	°	In.						
January	50·7	24·2	26·5	42·5	35·0	7·5	38·8	2·03	15	2	3	11	15	SW ½ W
February	52·3	26·9	25·5	43·5	35·8	7·8	39·7	1·48	13½	5	5	9	9	SW
March	55·0	28·4	26·6	46·1	37·1	9·0	41·6	1·61	14½	7	6	8	10	WSW ½ W
April	64·0	34·2	29·8	51·7	41·5	10·2	46·6	1·58	11	10	6	7	7	NNW
May	66·1	37·5	29·0	56·1	44·9	11·2	50·5	1·87	13	11	6½	6	7½	N b W
June	72·6	42·9	29·7	62·0	49·8	12·2	55·9	1·94	11	8½	5	8½	8	W
July	78·0	47·1	30·8	66·7	54·1	12·6	60·4	2·78	12	6	5	10	10	SW ½ W
August	73·8	46·3	27·5	64·1	53·6	10·6	58·9	2·04	12	5	5	9	12	SW b W
September	69·6	42·9	26·7	59·7	50·5	9·2	55·1	3·06	14	6½	4½	8	11	SW b W
October	61·9	34·4	27·4	52·5	43·9	8·7	48·2	3·22	16	4	4	10	13	SW b W
November	55·8	30·9	25·0	45·7	38·6	7·1	42·2	3·28	16½	6	6	8	10	WSW ½ S
December	51·9	25·6	26·2	42·5	35·5	6·9	39·0	3·40	18½	5	3	8	15	WSW ½ W
Means and Totals	62·6	35·1	27·6	52·8	43·4	9·4	48·1	28·29	167	76	59	102½	127½	WSW

The mean of the monthly minimum readings in January—the coldest month—is 24°·2, the lowest during the whole period being 13°·3, registered in 1875, on the first of the month.

The monthly range varies but little for the different months, the greatest being 30°·8, in July, and the average for the year 27°·6.

The day temperature rises from 42°·5 in January by very small increments to 46°·1 in March, thence by steps of about 5° each through the intervening months up to 66°·7 in July, from which point it falls by successive stages through the autumn months, though not quite so regularly as in its upward course, down to 42°·5 in December, being the same as that for January.

The night temperature performs a similar curve, though it neither rises nor falls quite so rapidly as the day temperature.

The daily range is the smallest in December, viz. 6°·9, and is indeed very moderate for both the autumn and winter months, the average from September to March (inclusive) being 8°. The greatest variations take place in the spring and summer, yet the maximum, which occurs in July, is only 12°·6.

The mean temperature for the different seasons, commencing with December for the winter quarter, is as follows:—winter, 39°·2; spring, 46°·2; summer, 58°·4; autumn, 48°·5, the last named being a fraction over the mean for the year. January shows the coldest with 38°·8, the highest being July with 60°·4, and the next, August, 1°·5 below July. One of the principal causes operating to bring about such a moderate and agreeable summer temperature is of course the close proximity of the town to the ocean, which in the warmest month of this season (according to the records of the Scarborough Philosophical Society, dating a few years ago) is about 5° below the air temperature. Another rather noticeable fact is, that in hot weather, with a tolerably clear sky, and a temperature between 8 and 9 a.m. of about 60°, rising to a maximum during the day of nearly 70°, the wind, which in the morning is blowing from the SW or WSW, generally backs to the SSE by the middle of the day, bringing in a cool refreshing breeze from the sea. This backward movement of the wind is easily accounted for, when it is remembered that with such a high temperature and an almost cloudless sky the ground becomes much heated, causing the lower stratum of warm and rarified air to ascend, while the cooler and heavier air is then drawn in from the sea to supply its place, the resultant wind for the remainder of the day being a gentle SSE breeze, generally of force 2 or 3 (sea scale), which resumes its normal SW direction during the night. The sea air, too, containing as it does a good deal of moisture, has, I believe, been shown by the Rev. F. W. Stow, in his investigations "on the absorption of the sun's heat rays by the vapour of the atmosphere" (Vol. II. p. 241), to be accompanied by a much less powerful sunshine. I think this particular movement of the wind in hot weather, and the cooling effects arising therefrom, have scarcely received due recognition at the hands of some writers, who, when they refer to places on the east coast, apparently imagine that those localities in summer receive nothing but the hot dry winds from across the country so long as the south-westerly current continues to prevail.

The autumn and winter temperature is also much influenced by the sea on the one hand, and by the shelter afforded by the surrounding hills on the other. The sea temperature appears to be about 5° warmer than the air in autumn, and 3° higher in the winter season, while the prevailing winds are south-westerly, and not felt in their full force.

The annual rainfall for the last ten years is 28·29 inches, descending in measurable quantities of not less than ·01 inch on 167 days. Adopting the previous division of the year, the amounts, arranged in order from the smallest upwards, are as follows:—spring, 5·06 in. on 38½ days; summer, 6·76 in. on 35 days; winter, 6·91 in. on 47 days; autumn, 9·56 in. on 46½ days.

As to the wind directions, it will be seen that in the winter quarter the southerly current blows almost exactly three times as long as the northerly one, but that the polar wind begins to increase from February till it overbalances the other in April, and reaches its maximum frequency in May. In July the equatorial current again predominates, and continues up to the end of the autumn to be about double that of the polar.

The spring, therefore, appears to be the least favoured season so far as regards the east coast. The air temperature is low, and that of the sea for April and May a trifle lower still; the proportion of north and east winds is greatest; mist and fogs are more frequent; and thunderstorms attain in their maximum in June, the average being about two for that month, and one and a half for July. In all other respects, however, the climate seems to be equable and salubrious.

The average number of times that the screen minimum thermometer has been below freezing is 31. The greatest number was 52 in 1870 and 1871; the least was 13 in 1868.

The number of times the maximum has not risen above freezing during any part of the day is 1½ on the average per year. The greatest number was 6 in 1870. In four years out of the eight there was no instance of it remaining below freezing all day.

The average number of times the maximum has exceeded 70° is 16 a year. The highest number was 27 times in 1868; the lowest number 4 times in 1875. The comparatively small number of times the maximum rises above 70° is probably due to the before-mentioned "backing" of the wind here in hot weather, which brings in the cooler sea air about the middle of the day, thus checking the more excessive rises of temperature.

As regards the rainfall, the wettest year out of the ten was 1872 with 39·33 inches, and the driest 1873 with 20·02 inches. The falls are seldom exceptionally heavy, only exceeding, on the average, 1 inch in the 24 hours between two and three times in the course of the year. The greatest number was 5 times, which occurred last year (1875), whilst in 1873 so much as an inch was never registered at one time.

The greatest falls attain their maximum frequency in the autumn months (September, October and November).

The effect of the moderate variations of temperature on the human

constitution may perhaps be better understood by the number of deaths from diarrhœa and dysentery, and from diseases of the respiratory organs. Taking an average of the last four years commencing 1872, when the Reports by the Medical Officer of Health (Dr. J. W. Taylor) began to be published, the deaths from diarrhœa, &c. have only been 1·0 per 1,000 of the population, and those from respiratory diseases 4·4, the latter including the large increase resulting from the severe cold of December, 1874, and the first week in January, 1875, which nearly doubled the mortality from this class of diseases, the number of deaths attributed to it alone during the first quarter of 1875 being 53, against an average of 29 for the previous 3 years. The average annual death-rate for the last 4 years has been 18·9 per 1,000.

Trusting there may be something of interest to the Fellows of the Society in this paper, I respectfully offer it as a small contribution to the meteorology of the north-east coast of England.

DISCUSSION.

Mr. SCOTT stated that the paper had been sent forward to the Society at his request, as he knew that Mr. Shaw had been discussing his observations carefully for several years. The situation of the thermometers was exceptional, being on a grass plot sloping towards the sea, and close to it, though at a height of 115 feet above it. He considered that the results would not apply to the climate of Yorkshire generally, as they did not agree very closely with those taken at Hawsker by Mr. Stow ; but Hawsker lies at some little distance from the sea, much less, therefore, could they be expected to agree with those taken more inland, *e.g.* at York.

Dr. TRIPE was glad to hear a paper on the temperature and other climatic conditions of a sea-side place, and hoped that similar ones would be received from other health resorts. He regretted, however, that there were no barometric readings given, but at the same time admitted that, though very desirable, they are not so important as those of temperature. Records of daily range of temperature are what we require, as these affect health far more than variations in the mean temperature.

Dr. MANN considered that the range of temperature was remarkably small for a place so far north. No doubt its close proximity to the sea and shelter on the landward side contributed materially to this result.

Mr. SYMONS thought that any climate could be obtained at Scarborough, that of the upper part of the town was like Hawsker, while that of the lower part closely resembled Bath. He should like to see similar observations from other health resorts, but one from each would seldom give a fair representation of the climate, as it varied in different parts of the towns, which were chiefly chosen for their rugged situation and picturesqueness. At present, the observations were chiefly made by medical men, who having a position to maintain, generally lived in the best parts of the towns, where ground was very dear, consequently the exposure of their instruments was very insufficient. Observations, to be of any scientific value, must be made on the same plan and under conditions as similar as possible. He instanced Brighton, where the instruments had been placed in the old Steyne Gardens, and the Corporation had done every thing in their power to make the station thoroughly efficient, but the Medical Officer of Health had at present only observed at 9 a.m., and thus the records were not available for comparison with the Society's regular stations.

XX. *Notice of Upward Currents during the formation and passage of Cumulus and Cumulo-Stratus Clouds.* By the Rev. Joseph Crompton, M.A., F.M.S.

[Received April 24th.—Read June 21st, 1876.]

Mr. Espy, the American meteorologist, many years ago founded, before the British Association at Glasgow, his theory of storms on the occurrence of strong upward currents during the formation of Cumulus clouds. His theory of the *centripetal* nature of hurricanes has not been accepted, but some of the facts on which he reasoned have not perhaps received the attention they deserved.

In the year 1866, October 31st, the city of Norwich, where I reside, was profusely decorated with flags from every church tower, chimney-top, and available eminence, to celebrate the first visit of the Prince and Princess of Wales. Four large banners were hoisted out of the upper loop-holes in the cathedral spire, I suppose about 16 feet from the summit, which is 300 feet high; on a church, St. George's, Tombland, were hung out a very large royal flag, and a very narrow streamer as well. The day after the gay doings of civic loyalty, November 1st, happened to be stormy, with frequent heavy showers of rain from the N and NE direction. Happening to walk through the "close" below the cathedral, I was struck with the unusual fluttering of the high cathedral flags. They were streaming with a strained quivering motion perpendicularly upwards all four of them, a heavy cloud was passing overhead at the moment, and as it passed the flags followed the cloud, and then gradually dropped into comparative quietness. Seeing that another cloud was rising in the distance, I waited. The flags were flying in the same direction as all the other church streamers, especially those mentioned on St. George's Tombland tower, and those at the base of the spire of the cathedral itself. As the cloud approached, the *upper* banners began to feel its influence, and streamed towards it *against* the direction of the wind, which still blew as before steadily on all below; as the cloud came nearer, the vehement quivering and straining motion of those flags increased, they began to take an upward perpendicular direction right into the cloud, and seemed almost tearing themselves from the staves to which they were fastened; again as the cloud passed they followed it as they had previously streamed to meet its approach, and then dropped away as before, one or two actually folding over their staves. All the other flags showed not the least symptom of disturbance, especially the long streamer from St. George's, Tombland, blowing the whole time remarkably steadily, and without flickering or quivering, as under the influence of a steady breeze, to its very extremity.

I called the attention of a policeman to the flags without any hint of any thing peculiar, and his start of surprise, his instant gaze at the other lower church flags, and his question how I accounted for such a strange way of flag-blowing, both verified the accuracy of my vision and made me think, as often I have done, what an amount of meteorological observation might be

obtained if policemen were but a little educated to observe facts somewhat above the elevation of area rails in quiet parts of our cities.

I called out a sailor friend close at hand, who was equally astonished with the policeman, and added the observation, "If that goes on, those flags will be ripped off their fastenings, or will rip themselves to pieces."

A few days after they were brought down from their elevation, and I was offered them for nothing, as they were useless for any future purpose, being nearly torn to ribbons and strips.

Mr. Espy mentions that he had kites, fastened with wire as well as string or cord, torn away by the upward stream of air near cumulus clouds, when forming even on a fine day. I can fully believe his statements from what I saw.

Doubtless similar observations have been made by other Fellows of the Society, though I have never before or since personally noticed the greatness of the force existing in the neighbourhood of clouds of a comparatively low elevation on what would be termed a day of frequent storms of wind and rain. I regret I had no means of testing up the spire the state of the currents between the heights of the neighbouring church towers and the castle parapets, in all of which the steadiness of the wind made a remarkable contrast with the rapid and violent changes so frequently renewed within a hundred feet or so above them.

DISCUSSION.

Dr. MANN did not think that the movement of the flag described could be attributed to any electrical influence. He should rather refer it to irregular and gusty currents of wind.

Mr. BROOKE thought that it was wholly the effect of electrical induction. The flag followed the cloud, which would naturally be the effect of electrical induction; but he could not understand why a current of air should follow the cloud, or how an upward current could be generated in so limited a space, as it appears that lower flags were not similarly affected.

Rev. W. C. LEY agreed with the electrical induction theory. In the place where he was now living he could look down on Leicester, and when cumulus and cumulonus passed over that town, the smoke commonly pointed up to the cloud. This was especially the case with heavy and dry cumulus travelling from polar quarters.

Mr. SCOTT said that Prof. Henry, at the Liverpool Meeting of the British Association, stated that he had noticed an upward movement of air during thunderstorms near Washington. The passage of such a storm over the country is marked by an ascending whirl of dust, which travels along in front of the storm.

Mr. WHIPPLE asked whether the flags were equally distributed round the building? The whole phenomenon seemed to be an electrical one, for it would require a current of wind at a high velocity to invert the flags, and it did not appear clear how such a current could be generated in the few feet between the upper and lower flags, without some indications being exhibited by the latter of its presence.

Dr. MANN said that the flags, being made of heavy bunting, and at the time saturated by rain squalls, would require a great force to raise them, much more, in his opinion, than could be accounted for by electrical induction. Electrical induction produces movement in light flocculent substances, not in heavy water-saturated masses. He had never seen any effect of this character electrically produced with flags; and should certainly be very cautious in considering that

the effect described was so produced under the circumstances here detailed. The nature of the motion spoken of in the flags, "straining violently," was that of movement produced by gusty and fitful wind, rather than that of a steady tension such as would characterise electrical induction.

XXI. *Suggestions on certain Variations, annual and diurnal, in the Relation of the Barometric Gradient to the Force of the Wind.* By the Rev. W. Clement Ley, M.A., F.M.S.

[Received May 11th.—Read June 21st, 1876.]

I have been for some years engaged in preparing a Paper on the Mean Relation of the Barometric Gradient to the Wind's Velocity, which will shortly, I hope, be laid before this Society. That Paper will contain tables of the mean velocity of the wind, corresponding to each barometric gradient, for each direction of the wind, at each of the seven Observatories in connection with the Meteorological Office where the self-recording instruments are in use; and in it I propose to discuss the degree in which the relation of gradient to wind-force is affected by variations in the curvature of the isobars and by other elements.

Soon after commencing to handle the materials for that work I was struck by a phenomenon, which it seemed desirable to make the subject of a separate paper, both as of importance in itself, and as likely, without the light of a previous discussion, to affect the value of the more general results. *The mean velocity of the wind corresponding to each gradient is much higher in summer than in winter.* This is the case at all stations (though not equally), with all winds,* with all lengths of radius of isobaric curvature, and with all values of actual barometric pressure.

The elements mentioned in the last sentence are for the present ignored. In Table I. is given the mean velocity of the wind at Stonyhurst, and in Table II. that at Kew, accompanying each gradient measured at 8 a.m. in the six months October to March, and in the six months April to September; the period examined being one for five years, viz. from August 1870 to July 1875. Stonyhurst and Kew were selected, because the mean velocities at those stations are not widely dissimilar; because it seemed desirable to exclude the supposition of possible complications arising from land and sea breezes; and lastly because the seasonal variations of which I am speaking are particularly well marked at those stations.

The data employed for obtaining the gradients were the Daily Telegraphic

*At such stations as Stonyhurst and Kew the polar currents are considerably stronger than the equatorial, with the same gradients (a fact which will be treated of hereafter). But there is no such predominance of polar winds in the summer compared with the winter half as would account for the phenomenon under discussion; and, further, the westerly and south-westerly winds proved, on a separate examination, to be (like the easterly and north-easterly) stronger, in relation to the gradients, in summer than in winter.

TABLE I.—STONYHURST.

Gradient per 50 nautical miles.	Gradient per 15* nautical miles.	Winter.		Summer.		Difference.
		No. of instances.	Mean Velocity in miles per hour.	No. of instances.	Mean Velocity in miles per hour.	
In.	In.					
·02	·006	61	3·22	145	5·74	2·52
·03	·009	123	4·63	189	7·27	2·64
·04	·012	140	5·96	187	11·11	5·15
·05	·015	168	10·33	144	14·83	4·50
·06	·018	97	12·00	60	16·29	4·29
·07	·021	86	13·09	57	18·86	5·77
·08	·024	79	15·95	46	20·98	5·03
·09	·027	50	21·25	*	*	*
·10	·030	35	24·06	*	*	*

TABLE II.—KEW

Gradient per 50 nautical miles.	Gradient per 15* nautical miles.	Winter.		Summer.		Difference.
		No. of instances.	Mean Velocity in miles per hour.	No. of instances.	Mean Velocity in miles per hour.	
In.	In.					
·02	·006	81	3·89	129	6·40	2·51
·03	·009	122	5·16	213	8·75	3·59
·04	·012	177	7·61	219	11·24	3·63
·05	·015	137	11·17	130	14·36	3·19
·06	·018	94	13·93	73	16·66	2·73
·07	·021	84	15·21	44	18·08	2·87
·08	·024	70	18·02	31	20·98	2·96
·09	·027	43	20·98	*	*	*
·10	·030	31	25·40	*	*	*

* The alteration in the denomination of the Gradient, from 50 miles to 15, adopted by the Permanent nmittee of the Vienna Congress, in order to secure uniformity between gradients according to British its, and those calculated on the principle of millimetres per 60 nautical miles, had not been introduced the time when the data in this paper were collected and discussed. A column is therefore inserted, wing the new gradients.

ports issued by the Meteorological Office. The isobars were in the first ace drawn as accurately as could be done for each day, and the gradients strumentally measured in the direction in which they were steepest over the ation, and across as small a geographical space as was in each case acticable. Gradients of less value than ·02 of an inch per 50 nautical iles, and of higher value than ·10 of an inch in winter and ·08 of an inch in mmer, were excluded, as not sufficiently numerous to yield a very reliable ean.

The velocities were obtained by measurement of the anemometric lines in e plates of the "Quarterly Weather Reports" up to the end of 1878, and ter that date from the "Hourly Readings" published by the Meteorological ommittee. The variations in the velocity of the wind in consecutive hours

being commonly very great as compared with the alterations in the steepness of the gradient in the same time, I have adopted throughout as the velocity for each day the mean of the velocities at 7, 8, and 9 a.m.

Two questions ought to be decided before the existence of Seasonal Variations in the Relation of Gradient to Wind-force can be regarded as established: 1st. Do the mean values of the gradients at 8 a.m. practically coincide with the mean values at other hours of the day? 2nd. Does the mean velocity in the three hours selected bear nearly the same relation to the mean diurnal velocity in summer as it does in winter?

To the first question an affirmative answer may readily be given. The character and amount of the mean diurnal oscillations of the barometer, as already known, exclude the supposition of appreciable mean diurnal changes in the steepness of the gradients over our Islands. I obtained, however, as well as I could, for a long period, from the data in the Quarterly Weather Reports, in conjunction with the 2 p.m. Telegraphic Reports, the mean values of the gradients at 2 p.m., with the anticipated result that they practically agree with those at 8 a.m.

In order to solve the second question, I obtained for the 19 months Jan. 1874 to July 1875 the mean velocities at all hours, and found that as regards Stonyhurst and Kew the mean of the 7, 8, and 9 a.m. velocities is indeed lower in winter than in summer as compared with the mean diurnal velocity; but that this difference is not of a magnitude sufficient to account for the difference of the summer and winter relations shown in the above Tables.

Very intimately connected with the subject of the present inquiry, is the question, what are the atmospheric conditions, as regards the mean horary velocity of the wind, which characterise the summer and winter seasons respectively?

The general character of the mean diurnal variations of velocity, as these occur at the stations in the British Isles, may be fairly inferred from mean horary velocity curves, deduced from the Hourly Readings already issued by the Meteorological Committee; and it may be described as follows:—

At the inland stations, *in summer*, a slight increment of velocity occurs about midnight. This is succeeded by the morning minimum, which takes place, in most of the months that I have examined, a little after sunrise. The mean velocity then rises briskly until 1 p.m., when the diurnal maximum is sometimes attained. A slight subsidence then commonly occurs, but the mean velocity rises again at 3 or 4 p.m., and this 2nd increment frequently forms the diurnal maximum. A great fall then takes place, which is more rapid than the rise in the morning; and the evening minimum, which is in most months the diurnal minimum, is attained about 10 p.m. The mean velocity at 1 p.m. is, in fine and hot weather, more than double the 10 p.m. velocity in miles per hour, and exceeds the diurnal mean by about $\frac{1}{3}$rd. *In winter* the inflexions are very greatly modified. The midnight rise is not in all months traceable, and the subsequent diminution is not very great. The morning minimum occurs about sunrise. The diurnal maximum takes place about 1 p.m., is less than double the minimum in miles per hour, and exceeds the mean for the day by about $\frac{1}{8}$th only.

At the coast stations the mean horary curve in summer approximates in type to the winter curve at the inland stations, the diurnal maximum being attained about 2 p.m., and rarely being double the minimum in miles per hour; and the latter still occurring about 10 p m. Neither is there so marked a distinction between the summer and winter curves at the coast as at the inland stations.

So far as I have been able to examine the subject, I must say that I have found no very obvious or distinct relation between the mean diurnal variations of wind force and those of the temperature of the air. Such a relation, however, does seem to exist between the mean diurnal variations of wind force and those of the barometer, the barometric maxima being, as a general rule, *nearly* contemporaneous with the anemometric minima, and *vice versâ*. This relation is *generally* discernible in the characteristics of our summer and winter inland and sea-coast observations; for as regards the mean diurnal oscillations of the barometer, the p.m. minimum takes place earlier in winter, and at the coast stations, than in summer, and at the inland stations. It may also be even *particularly* traced in the mean horary barometric and anemometric curves for a period of one or more months at one station, if the period selected be free from sudden and great accidental variations of pressure (such as are due to the rapid passage of cyclonic disturbances), or if the days on which those occur are excluded.

It is commonly supposed that the force of the wind is due solely to the barometric gradient, in other words, to the differences (temporary or accidental in our regions of the globe) in the geographical distribution of atmospheric pressures. This conception will have to be slightly modified, if the reasoning in the present paper be accepted as correct. In our own latitudes it is only by eliminating the accidental oscillations of the barometer that we discover the mean diurnal oscillations. And we now find that the atmospheric conditions to which these latter are related operate as a kind of co-efficients of the gradients in determining the wind's velocity. If this applies, as may be inferred, to other districts of the globe, we shall not be surprised to find that an equation like Mr. Ferrel's, which takes no account of these co-efficients, should give us for low latitudes, where the mean diurnal fluctuations are very great, theoretical velocities which are rather too low as compared with observed velocities.

How are we to regard these co-efficients? Are we to understand them as affecting the velocity of the wind irrespectively of its direction, or not? And again, are the mean horary variations of barometric pressure to be regarded as the *cause*, or rather as the *consequence*, of the increments and decrements of motion in the atmosphere? The temptation to approach these problems from a theoretical point of view is strong. They have already been in some measure so attacked by Mr. Laughton.* But, in a subject so little investigated, theory is at present of little value, except as guiding observational

* "Diurnal Variations of the Barometer:" Quarterly Journal of Meteorological Society, Vol. II, pp. 159-163.

study. I do not pretend to be able to solve these problems; but I would indicate the way in which I think they may be advantageously approached from the observational side. The data of the invaluable "Hourly Readings," if thoroughly worked out, as they will be by abler hands than mine, will go far to settle such questions.

E.g. if we obtain the mean horary velocity curves at any inland station from all the days throughout which an easterly current occurred, and compare them with the corresponding curves of the days throughout which there was a westerly wind, we shall at once solve the question as to whether there exists a westward translation of the atmosphere in the morning, and an eastward in the afternoon, arising from causes which are irrespective of the barometric gradient. As a specimen of the manner in which this may be done, I give in the accompanying diagram the mean horary velocity curves of the days of easterly winds (138), and of westerly winds (259), at Stonyhurst in the 22 months, January, 1874, to October, 1875.

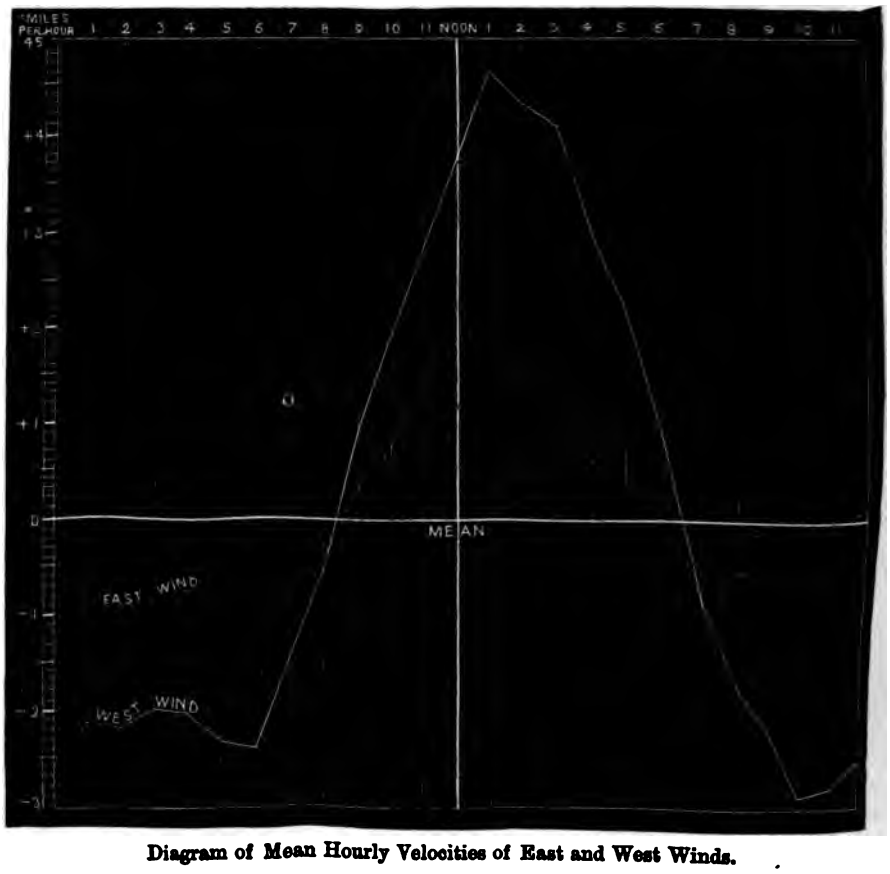


Diagram of Mean Hourly Velocities of East and West Winds.

The diagram shows that there is no great difference between easterly and westerly winds, as regards the *hours* of increment and decrement at

an inland station. The contrast in the *amplitude* of the variations is remarkable; and is insufficiently (as I think) accounted for by the fact that 58 per cent. of the days of easterly wind, as against 40 per cent. of those of westerly, were contributed by the winter months in the period examined.

I have left till last a consideration of a purely *à priori* character, and it is one to which I attach very slight importance. *Valeat quantum.* So far as it goes, it tends in nowise to explain, but solely to magnify, the remarkable nature of the contrast between the seasonal relations of gradient and velocity. The period from April to October nearly coincides with the foliage period of the deciduous trees. It is natural to suppose that the growth of foliage exercises a retarding influence on the wind's velocity, as measured not only by ill-exposed anemometers, but by all anemometers in tolerably well-wooded districts. An analogy may be drawn from what, as Mr. Froude informs me, is a well-known result of the growth of weeds in rivers; the water is occasionally maintained in summer at its winter level solely by the increased friction encountered by the current in the bed of the river. We shall expect that an effect of a similar kind, though exceedingly different in degree, may be experienced by the atmospheric currents in summer as compared with winter, at such stations as Stonyhurst and Kew.

DISCUSSION.

Mr. SCOTT said that the work upon which Mr. Ley was engaged was a very important one. In a discussion of the winds near the Equator, which had been undertaken by Captain Toynbee, it was found that there was an extraordinary difference between the force of the wind corresponding to each barometric gradient in that region and that which was the case in England. The gradients in the NE and SE Trades, moreover, are different, even when close together; there could therefore be no simple proportion between the barometric gradient and the force of the wind. Drs. Mohn and Guldberg had been engaged on the motion and force of the wind for some time, and their results would be published shortly. He quoted the following notes by Captain Toynbee on the subject:—"Perhaps some illustration may be thrown on the subject by comparing the gradients and accompanying winds of these Islands with those of the tropical regions of the Atlantic. We find that there is much more wind in the tropics than in these latitudes, *with the same gradient.* I am inclined to think that the difference has various causes.

"1st. The tropical gradients are much more permanent than those of these latitudes.

"2nd. The tropical gradients generally extend over a much greater distance.

"I would also call attention to the fact that from June to October the gradient of the NE Trade is steeper than that of the SE Trade *with the same amount of wind;* which is probably caused by a downward current in the north part of the NE Trade (see our diagrams for illustration of this)."

Mr. BROOKE mentioned an instance of the influence of foliage on the force of the wind. A friend residing on a plateau, above a grassy slope, partially covered with patches of brushwood, had remarked to him that when the wind was blowing up the slope, he always felt a considerable diminution of its force when standing above a patch of brushwood, although not perhaps very close to it.

Mr. WHIPPLE said that the curve exhibited was somewhat similar in its features to that of the Declination magnet. The results were classified into two portions, summer and winter; and although the curves were not so marked, they bore a great similarity to each other. He was surprised to see the minimum occur at 10 o'clock, as it was generally looked for about sunrise. He thought that the E and NE winds at Kew were not influenced by trees, as there was no obstruc-

tion in those directions for more than a mile. The results obtained from [illegible] anemometers at different elevations were very marked. At Kew it was found [illegible]d that an anemometer twelve feet above the ground only registered about half as [illegible]s much as one on the roof of the Observatory.

Mr. Scott said that the proximity of trees at Stonyhurst and Kew most [illegible]st probably affected the results obtained.

Rev. W. C. Ley thought that there might be some relation between the curves [illegible]es of the oscillations of the wind, and those of temperature, elastic force of vapour, [illegible]r, the magnetic variations, &c. as well as the diurnal oscillations of the barometer. [illegible]er.

XXII. *De la Vulgarisation par la Presse des Observations météorologiques.* [illegible]s.

Par Harold Tarry, F.M.S.

[Received June 7th.—Read June 21st, 1876.]

Un des signes distinctifs du progrès scientifique de notre époque, c'est [illegible]st le développement de plus en plus rapide, la diffusion sur une très-large échelle [illegible]e, des connaissances et des observations météorologiques auxquelles on est [illegible]st parvenu à intéresser un public de plus en plus nombreux et attentif. Un [illegible]n réseau très-serré d'observatoires météorologiques couvre la plus grande [illegible]e partie de l'hémisphère boréal; des milliers de télégrammes internationaux [illegible] s'échangent entre tous les pays pour l'étude de la marche des tempêtes; les [illegible]s avertissements météorologiques, en vue des besoins agricoles, sont organisés [illegible] déjà aux Etats-Unis depuis plusieurs années, ils ont été inaugurés en France [illegible] par M. Le Verrier le 1er Mai de cette année, et ils sont près de fonctionner [illegible] dans d'autres Etats; enfin, les saines notions sur le but et les moyens d'action [illegible] de cette science, qui entre ainsi de plus en plus profondément dans les habitudes et les besoins de chaque jour, se propagent avec une grande rapidité [illegible] et un succès toujours croissant.

Lorsque l'on examine les conditions dans lesquelles s'est effectué ce grand [illegible] mouvement scientifique, on reconnaît que la vulgarisation par la voie de la [illegible] presse y a joué un rôle prépondérant.

Sans doute, les deux grands Congrès Météorologiques Internationaux de Bruxelles et de Vienne ont fait faire à cette science nouvelle des progrès décisifs, l'organisation, dans tous les pays, de services d'avertissements météorologiques envoyés chaque jour aux ports, a appelé sur elle l'attention des gouvernments et du public, enfin, les observations faites simultanément dans tout l'hémisphère boréal et la publication de cartes synoptiques quotidiennes du temps par l'Institut Météorologique de Danemark, donneront le moyen de découvrir les lois des variations périodiques ou accidentelles des éléments météorologiques.

Mais ces importants progrès n'auraient eu d'écho que dans les sociétés scientifiques, dont les membres se tiennent au courant, à l'aide de publications spéciales, des résultats obtenus, si les journaux n'étaient venus d'initier la masse du public, par des publications quotidiennes, à ces efforts, et l'engager à y coopérer.

Parmi les moyens adoptés, la publication de *Cartes du Temps* et de *Diagrammes* présentant, à l'aide de *Courbes*, le tableau synoptique de la situation

atmosphérique sur tout un pays, ou de la variation de ses principaux éléments en un lieu donné, c'est-à-dire des résultats fournis par la météorologie dynamique ou internationale, et par la météorologie statique ou locale, ont été, à coup sûr, ceux qui ont le plus contribué à cette diffusion si désirable.

I. C'est aux Etats-Unis que ce mouvement a pris naissance. Dans ce pays, grâce à un large budget assuré depuis plusieurs années au service météorologique (250,000 dollars par an), les *Weather Maps*, publiées trois fois par jour, affichées partout et tirées à un nombre considérable d'exemplaires, ont rapidement popularisé la connaissance et l'étude du temps, et l'habitude d'attacher aux observations simultanées une signification pratique d'une grande importance.

En Europe, quatre pays seulement publient chaque jour des cartes du temps : la France, l'Angleterre, l'Allemagne et le Danemark ; mais, ces publications officielles, faites par les soins de l'Observatoire de Paris, du *Meteorological Office* de Londres, du *Deutsche Seewarte* de Hambourg, et de l'Institut Météorologique de Copenhague, ne sont tirées qu'à quelques centaines d'exemplaires, et les météorologistes seuls les reçoivent ; le prix de l'abonnement est d'ailleurs élevé (36 *f. par an en France*, 1 *livre sterling en Angleterre et* 36 *marcs en Allemagne.*)

Le *Times* de Londres a, le premier, inauguré la publication, par la voie des journaux politiques, des *Weather Maps* ; dans son édition de deux heures du soir, il reproduit chaque jour la Carte du Temps du *Meterological Office*, et dans son édition du matin il publie, à l'aide d'informations particulières, une seconde Carte du Temps qui donne la situation générale atmosphèrique du nord-ouest de l'Europe la veille à six heures du soir ; pour cette seule publication météorologique, il n'a pas hésité à dépenser 500 *livres sterling par an*, cette somme représentant, bien entendu, les frais d'observation, de transmission télégraphique et de travaux spéciaux pour ce service au *Meteorological Office.*

Depuis quelques mois, la presse française a suivi cet exemple ; le journal *l'Opinion Nationale* s'était déjà fait remarquer, il y a trois ans, par la publication d'une série de bulletins météorologiques qui ont précédé et peut-être facilité l'élaboration du décrêt du 18 Février 1878 réorganisant la météorologie française ; il a pris des arrangements avec l'Observatoire de Paris et avec le nouvel éditeur du *Bulletin International*, et, depuis le mois de Décembre 1875, il reproduit chaque soir la Carte du Temps du jour, qui se trouve ainsi tirée à un nombre considérable d'exemplaires.

Les cartes publiées par *l'Opinion* sont beaucoup plus nettes que celles du *Times ;* les courbes d'égale pression barométrique y sont en traits pleins et non en pointillé, l'échelle est plus grande et l'étendue du pays représenté est plus que doublée.

Cette publication constitue donc un progrès sérieux, et il ne sera pas sans intérêt d'expliquer par quel procédé on est arrivé à ce résultat : c'est à l'aide de la *gravure chimique en relief :* voici comment les choses se passent :—

Chaque jour, l'Observatoire de Paris envoie, vers deux heures de l'après-

midi, la minute du *Bulletin International* aux ateliers de gravure chimique de MM. Yves et Barret. Cette minute, écrite sur du papier spécial, arrive à l'atelier vers 2½h., et est immédiatement reportée sur la pierre lithographique servant au tirage du Bulletin lithographié que reçoivent les correspondants de l'Observatoire et les abonnés.

Dèsque le report sur pierre est achevé, c'est-à-dire vers trois heures, à l'aide d'une épreuve sur papier chine, on fait un report sur une planche de zinc ; lorsque le dessin est reproduit sur le métal, on attaque ce dernier par l'acide azotique, à l'aide de procédés spéciaux dont MM. Yves et Barret ont le secret.

Cette opération nécessite des soins minutieux, des retouches nombreuses, une surveillance incessante ; mais les ouvriers, dressés depuis plusieurs années à ce travail, y ont acquis une telle habileté, qu'il se fait presque mécaniquement, et que les morsures de l'acide sont dirigées avec autant de sureté que la pointe d'un burin. Au bout de 8 heures d'immersion, le métal a été attaqué partout où doivent subsister les blancs du dessin, et celui-ci ressort en relief sur la plaque.

On cloue alors sur bois la plaque ainsi préparée, et on a un *cliché*. Ce cliché est envoyé à 6½h. au journal *l'Opinion*, mis immédiatement sous presse, et la poste distribue le soir à Paris, en même temps, et le *Bulletin International* et sa reproduction dans le journal ; l'un et l'autre sont expédiés en province et à l'étranger par les courriers du soir.*

II. Indépendamment des Cartes du Temps, les journaux anglais et américains publient aussi des courbes quotidiennes ou hebdomadaires faisant connaître la variation des éléments météorologiques pendant le jour ou la semaine écoulée. Ainsi, le *New York Tribune* publie chaque jour, en Amérique, un diagramme donnant la courbe continue des hauteurs barométriques ; le fond quadrillé du dessin se compose de petits carrés dont chacun correspond pour la largeur à une heure de temps et pour la hauteur à un dixième de pouce ou 2^{mm} 5, ce qui permet d'evaluer la pression à chaque quart d'heure à moins d'un vingtième de pouce.

Dans ce pays, du reste les connaissances relatives à l'état du Temps sont mises à la portée de tous, et *sept mille bureaux de poste* affichent chaque matin, dans un cadre bien en vue, les renseignements extraits par le *Signal Service* de Washington des observations faites la veille à 11 heures du soir.

En Angleterre le *Times* publie chaque jeudi un diagramme qui fait connaître, à l'aide de courbes se détachant en noir sur fond blanc : 1° la hauteur barométrique, 2° la température marquée par les thermomètres secs et mouillés, 3° la direction du vent et sa vitesse en milles.

Ces tableaux synoptiques parlent beaucoup mieux aux yeux que des colonnes de chiffres, et ils sont parfaitement nets ; mais l'échelle adoptée est

* Le procédé du *Times* est plus expéditif ; il reçoit du *Meteorological Office* la Carte du Temps à 11 heures du matin, fait un cliché en plâtre et met sous presse à midi et demi, c'est-à-dire une heure et demie après. La carte du soir lui est remise à 9 heures, et le journal est mis sous presse à 2 heures du matin.

rop petite pour qu'on puisse bien saisir les variations de courte durée. ainsi, l'intervalle d'une journée n'est représenté sur les abscisses que par 15 aillimètres de longueur, et une hauteur barométrique de 4 millimètres de aercure correspond à une ordonnée de 8 millimètres: les courbes sont nvoyées par l'Observatoire de Kew.

D'autres journaux anglais ont imité l'exemple du *Times*, et publient égalenent des courbes météorologiques hebdomadaires de même nature: ce sont *'he Graphic*, *The Observer*, et *Lloyd's Paper;* les courbes identiques qu'ils lonnent sont encore à une échelle plus petite.

J'ai pensé qu'il y aurait un grand intérêt à suivre, en France, l'exemple lonné par ces publications, qu'il était même possible de faire mieux, plus vite t à meilleur marché, et grâce au concours éclairé des administrateurs du ournal *l'Opinion*, que ses antécédents désignaient pour une pareille entative, grâce aussi aux procédés de MM. Yves et Barret qui ont fourni l'excellents moyens d'exécution, et à l'obligeance de MM. Rédier qui ont ien voulu donner la courbe du baromètre-enregistreur à mercure que l'on pu voir fonctionner l' année dernière au Congrès International des Sciences léographiques, j'ai réussi autant qu'il était permis de l'espérer. Dans e cas, le procédé devait être différent, parceque le Journal *l'Opinion*, ayant rganisé un service d'avertissements météorologiques destiné à compléter s avis de l'Observatoire, il importait de publier des observations faites en ernière limite d'heure, c'est-à dire jusqu'à 6 heures du soir: voici comment n y est arrivé:—

Le dessin du diagramme servant au tracé des courbes quotidiennes est fait ur une pierre lithographique servant de *matrice*.

Cette matrice étant obtenue, sert à former à l'aide des procédés de la ravure chimique en relief, ainsi qu'il a été dit plus haut, des clichés métalques sur lesquels les creux correspondent aux lignes saillantes de la matrice t réciproquement, de manière que, par l'impression typographique, le uadrillé du fond ressort en blanc sur fond noir.

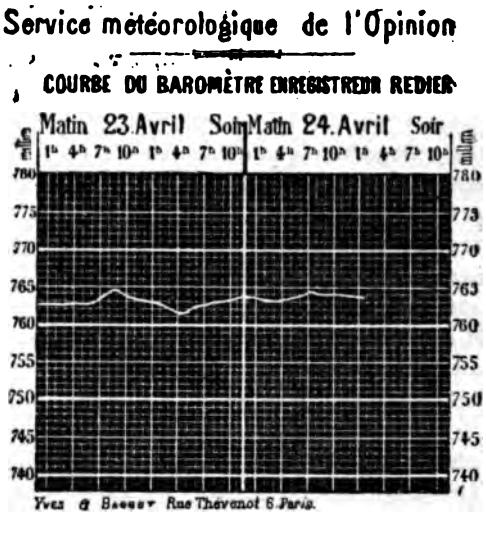
Ces clichés sont faits à l'avance, ainsi que les tirages à part du quadrillé, ui servent à effectuer le tracé de la courbe donnée par le baromètre. A 6 eures du soir, la courbe barométrique, dont le tracé a été préalablement ommencé, est achevée et portée à l'atelier de gravure; là un ouvrier prend n des clichés faits d'avance et y trace la courbe en donnant un coup de urin aux endroits marqués sur le modèle, c'est l'affaire d'un quart d'heure; uis, le cliché contenant la courbe du jour est porté à l'imprimerie du journal ui met sous presse à 6¼h., et une heure après, en recevant le journal, on eut y lire d'un seul coup d'œil la marche du baromètre pendant toute a journée. Cette rapidité d'exécution fait le principal mérite de la méthode mployée, et ce n'est pas sans de laborieux tâtonnements qu'on est enfin rrivé à ce résultat.

On avait d'abord hésité à confier la préparation des clichés à des ateliers ui ne fussent pas placés dans l'imprimerie même du journal; on avait eu ecours, au début des essais, aux procédés typographiques seuls, en compoant, à l'aide de points séparés, une courbe *discontinue* qui donnait heure

par heure la hauteur barométrique, et dont un spécimen a été reproduit dans le feuilleton sur les *Avertissements météorologiques agricoles* publié par *l'Opinion* du 22 Avril, 1876.

Mais, si la solution était satisfaisante en théorie, elle se trouva inapplicable dans la pratique de l'atelier; le maniement de caractères presque microscopique qu'il fallait déplacer chaque fois aux points où devait passer la courbe, exigeait une attention et un soin tels, qu'aucun compositeur ne voulut s'en charger; il aurait d'ailleurs fallu beaucoup de temps pour la composition et pour la correction, et après avoir étudié en détail ce procédé, nous croyons qu'on ne peut pas l'employer avantageusement. C'est alors que nous avons eu recours au procédé de la gravure chimique en relief, qui donna de suite un résultat satisfaisant; nous pensons qu'on serait également arrivé au but par la photoglyptie (procédé Woodbury).

Le 24 Avril, les administrateurs de *l'Opinion* déposaient à 8 heures du soir sur le bureau de l'Académie des Sciences un tirage à part de la courbe barométrique du jour, allant jusqu'à 2 heures du soir; nous reproduisons cette courbe ci-dessous:—



Dans un mémoire explicatif, ils exposaient en même temps à l'Académie les bases qui avaient servi à l'organisation d'un service météorologique dans leurs bureaux, pour la rédaction d'avertissements destinés spécialement à l'agriculture, faisaient ressortir les services que peut rendre la presse quotidienne pour la transmission rapide de ces avertissements, et se mettaient à la disposition de l'Académie pour réaliser, dans leurs publications météorologiques, toutes les améliorations qu'elle voudrait bien leur suggérer.

L'Académie des Sciences a paru frappée de l'utilité d'une pareille entreprise, et a nommé une commission composée de MM. Le Verrier, Ch.

inte-Claire-Deville et Amiral Pâris pour lui faire un rapport sur cette estion.

En attendant, M. Louis Redier construit un baromètre-enregistreur qui avera lui-même la courbe sur le cliché, et s'il parvient à triompher des fficultés d'une pareille entreprise, cet appareil étant établi dans les bureaux journal, on pourra faire le tirage de la courbe dix minutes après la dernière servation.

Quant aux améliorations de détail, elles se feront peu à peu. D'après l'échelle doptée, les abscisses correspondent à un millimètre par heure, et les varia- ons de la colonne barométrique sont reproduites en grandeur naturelle, c'est-dire qu'une hausse d'un millimètre de mercure correspond à une élévation un millimètre de la courbe; une échelle double serait peut-être préférable; ne table de correction que nous calculons spécialement pour la réduction au veau de la mer du point où est situé l'instrument, donnera une plus grande écision, enfin, on donnera bientôt la courbe du thermomètre; tout cela se erfectionnera et se complètera peu à peu. Un point important, c'est que le ix de revient est modique et que le procédé est à la portée de tous les urnaux de la provinces et de l'étranger.

MM. Yves et Barret peuvent envoyer, dès à présent, à tout journal qui demandera, moyennant 640 francs, soit 1f. 75c. par jour, les clichés cessaires pour chaque jour de l'année, et sur lesquels un ouvrier de la calité n'aura qu'à tracer au burin, en quelques minutes, la courbe qui lui ra remise par l'observateur. Il n'est donc pas douteux que l'innovation alisée par le journal *l'Opinion* se propagera rapidement parmi les journaux les revues scientifiques de tous les pays.

Déjà le journal hebdomadaire *les Mondes* de l'abbé Moigno, a publié la urbe ci-dessus dans le numéro du 4 Mai (page 242), et le Bulletin météoro- gique, No. 340 (20 Mai) du gouvernement général de l'Algérie a imité cet emple en faisant remarquer combien "les publications de cette nature ritent de fixer l'attention des personnes qui s'intéressent aux études étéorologiques."

En outre *l'Illustration* a déjà donné dans le numéro du 5 Mai et publiera us les mois un diagramme représentant par des courbes, ce qui est le eilleur procédé de vulgarisation, les observations météorologiques du mois écédent faites à l'Observatoire Montsouris; et, dans quelques jours, les evues scientifiques *la Nature* et *les Mondes* publieront chaque semaine, à xemple des journaux anglais, une courbe hebdomadaire, qui aura 140 illimètres de long dans le premier journal et 168 dans le second, et présentera ainsi, à une échelle très-convenable (20 et 23 millimètres par ur) les principales observations météorologiques de la semaine écoulée.

PROCEEDINGS AT THE MEETINGS OF THE SOCIETY.

MAY 17th, 1876.

Ordinary Meeting.

HENRY STORKS EATON, M.A., President, in the Chair.

JAMES LLOYD ASHBURY, M.P., 66 Grosvenor Street, W.;
JOHN BROUN, F.G.S., Littleworth House, Hednesford near Stafford;
JOHN BROWN, Assoc. Inst. C.E., Altwood, Maidenhead;
EDMUND CRUSE, Warminster, Wilts;
JAMES ELDRIDGE, Assoc. Inst. C.E., Gas Works, Richmond, Surrey;
GEORGE GARNETT, Assoc. Inst. C.E., The Friars, Monkton Street, Ryde Isle of Wight;
JOHN HOPKINSON, F.L.S., Holly Bank, Watford;
ROBERT PICKWELL, Assoc. Inst. C.E., 139 High Street, Hull;
WILLIAM FORD STANLEY, F.R.M.S., Stanleybury, South Norwood, S.E.;
RUPERT SWINDELLS, Assoc. Inst. C.E., Old Trafford, Manchester;
CHARLES TARRANT, M. Inst. C.E., Belvedere Road, Tranmore, Co. Waterford; and
THOMAS TAYLOR-SMITH, M. Inst. C.E., Urpeth Hall, Chester-le-Street, Durham,

were balloted for and duly elected Fellows of the Society.

The name of One Candidate for admission into the Society was read.

The following papers were then read :—

"Remarks on the present condition of Maritime Meteorology." By ROBERT H. SCOTT, M.A., F.R.S. (p. 185.)

"On the Mean Temperature of every day at the Royal Observatory, Greenwich, from 1814 to 1873." By JAMES GLAISHER, F.R.S. (p. 198.)

"On the Meteorology of Mozufferpore, Tirhoot, for 1875." By C. N. PEARSON, F.M.S. (p. 222.)

"New Wind Chart." By Lieut.-Gen. GEORGE ERNEST BULGER, F.M.S.

As the usual modes of registering the wind were all more or less unsatisfactory to me, I essayed to construct a chart, which would show at a glance not only the direction of the breeze at certain times, but the changes during any required period as well; and a diagram, exemplifying the result of my efforts with regard to these points, was submitted to the Fellows at the Meeting.

The diagram referred to embodies the variations observed at the Camp, Colchester, Essex, during the month of July, 1874, at 9 a.m. daily, and may be briefly described as follows. It consists of a series of thirty-two concentric circles, rather less than a quarter of an inch distant from one another, and (with the exception of the innermost) divided equally into sixteen parts by radial lines. The central circle is one inch in diameter, and contains a memorandum of the name of the place where the records were kept, the name of the month, and the hour at which the daily observation was taken. The space between the inner circle and the second one is assigned to the first day of the month, that between the second and third circles to the second day, that between the third and fourth circles to the third day, and so on, working outwards through the whole thirty-one days; while the radial divisions are allotted to the four cardinal points of the compass and the twelve principal subordinate ones—each division being marked with its appropriate letter or letters at the outer edge of the figure: a final circular double line, embracing the entire diagram, is only employed to give it a more finished appearance.

The mode of registration is very simple and requires no explanation. On the first four days of the month the wind was South-west, and I, consequently, placed a dot in each of the circular spaces allotted to those four day under the radial heading SW; on the following morning a slight change had occurred, and

the vane indicated West, so that my entry was made in the proper circular space for that day under the heading W; and on the 6th a further alteration to the North-west having been shown, the daily dot appeared under the heading NW. This process was continued throughout the month, and, finally, I connected the various dots by curved lines, and completed the diagram. I subsequently, however, entered the dates in small figures close to the various dots, and I found that the record was not only thereby rendered much more precise and perfect, but its facilities for reference were greatly increased.

It is scarcely necessary to mention that the force of the wind, as well as the direction, can be noted very readily on these diagrams, and many ways of doing so will, of course, occur to observers. I think, however, that a simple record in figures will answer most purposes, or, the curved connecting-lines may be barbed and feathered as required.

If three or more observations are taken daily, the chart should, in my opinion, be confined to one week; as, otherwise, the necessary number of circles would render it inconveniently large; and, for the same reason, if hourly observations are recorded, each day should have a diagram to itself.

Numerous modifications of this principle will no doubt suggest themselves, and the records can be made more or less elaborate and complete, as necessity or fancy may point out.

The Meeting was then adjourned.

JUNE 21st, 1876.

Ordinary Meeting.

HENRY STORKS EATON, M.A., President, in the Chair.

BENJAMIN THOMAS, L.R.C.P., Llanelly, Carmarthenshire,
was balloted for and duly elected a Fellow of the Society.

The names of Three Candidates for admission into the Society were read.

The following papers were then read:—

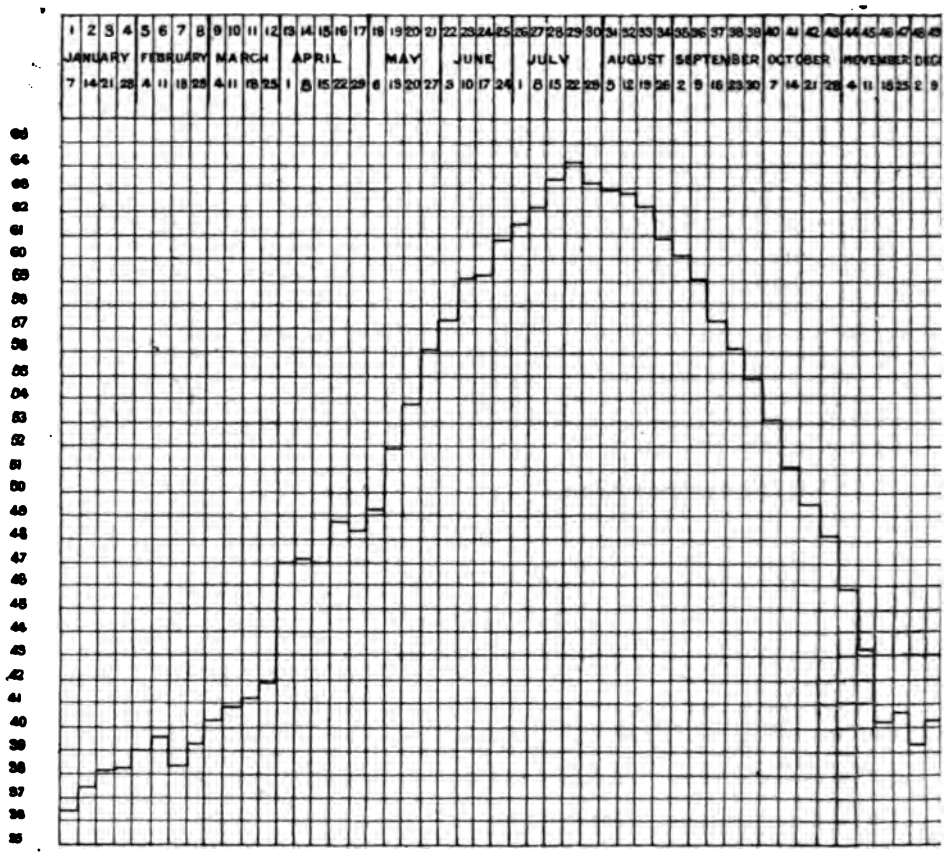
"The Climate of Scarborough." By FRANCIS SHAW, F.M.S. (p. 225.)

"Notice of Upward Currents during the formation and passage of Cumulus and Cumulo-Stratus Clouds." By the Rev. JOSEPH CROMPTON, M.A., F.M.S. (p. 230.)

"Suggestions on certain Variations, annual and diurnal, in the relation of the Barometric Gradient to the Force of the Wind." By the Rev. W. CLEMENT LEY, M.A., F.M.S. (p. 232.)

"Average Weekly Temperature of 30 Years, 1846-75, for Cardington." By JOHN MCLAREN, F.M.S.

The accompanying diagram exhibits the mean temperature of every week during the year of 52 weeks, as deduced from the daily maximum and minimum thermometer readings. The heading of the diagram shows the weeks and the months with the days of the months on which each week of seven days ends, except the last week of the year which has eight days and on leap year the ninth week ending on March 4th has eight days. The diagram, something in the form of a ladder, shows a thirty years average of the mean of each week. That ending on January 7th shows the average mean of the first week in the year to be 36°·6. It then rises by degrees and tenths of a degree and shows that the warmest week of the year on the average is the 29th week, ending July the 22nd, and represents 64°·2, thence stepping gradually down to the end of December. The thermometers have been compared with standard instruments at the Royal Observatory at Greenwich by Mr. Glaisher. They are placed at the height of five feet from the ground and five feet from other objects, are protected from radiation and rain, and are read and set at 9 a.m.



The following are the actual temperatures shown in the above diagram :—

| | | |

					°
20th	Week ending	May	20th	.. ..	53·8
21st	,, ,,	,,	27th	.. ..	56·1
22nd	,, ,,	June	3rd	.. ..	57·5
23rd	,, ,,	,,	10th	.. ..	59·2
24th	,, ,,	,,	17th	.. ..	59·3
25th	,, ,,	,,	24th	.. ..	60·8
26th	,, ,,	July	1st	.. .. ,. ..	61·5
27th	,, ,,	,,	8th	.. ..	62·2
28th	,, ,,	,,	15th	.. ..	63·5
29th	,, ,,	,,	22nd	.. ..	64·2
30th	,, ,,	,,	29th	.. ..	63·4
31st	,, ,,	August	5th	.. ..	62·9
32nd	,, ,,	,,	12th	.. ..	62·8
33rd	,, ,,	,,	19th	.. ..	62·3
34th	,, ,,	,,	26th	.. ..	60·9
35th	,, ,,	September	2nd	.. ..	60·1
36th	,, ,,	,,	9th	.. ..	59·1
37th	,, ,,	,,	16th	.. ..	57·5
38th	,, ,,	,,	23rd	.. ..	56·3
39th	,, ,,	,,	30th	.. ..	54·9
40th	,, ,,	October	7th	.. ..	53·2
41st	,, ,,	,,	14th	.. ..	51·1
42nd	,, ,,	,,	21st	.. ..	49·5
43rd	,, ,,	,,	28th	.. ..	48·2
44th	,, ,,	November	4th	.. ..	45·9
45th	,, ,,	,,	11th	.. ..	43·4
46th	,, ,,	,,	18th	.. ..	40·4
47th	,, ,,	,,	25th	.. ..	40·7
48th	,, ,,	December	2nd	.. ..	39·4
49th	,, ,,	,,	9th	.. ..	40·3
50th	,, ,,	,,	16th	.. ..	39·7
51st	,, ,,	,,	23rd	.. ..	38·2
52nd	,, ,,	,,	31st	.. ..	36·9

"De la Vulgarisation par la Presse des Observations Météorologiques." By HAROLD TARRY, F.M.S. (p. 238.)

The Meeting was then adjourned.

Donations received from July 1st to September 30th, 1876.

Presented by Societies, Institutions, &c.

Brussels	Observatoire Royal... ..	Annals, June to August.
Calcutta	St. Xavier's College Observatory	Meteorological Register, January to June. By Rev. E. Francotti, S. J., Director.
Copenhagen ..	Danske Meteorologiske Institut	Annuaire Météorologique pour l'année 1875.
	" "	Bulletin Météorologique du Nord, June 1st to August 31st. By Capt. N. Hoffmeyer, Director.
Cracow	K. K. Sternwarte	Meteorologische Beobachtungen, May to July. By Dr. F. Karlinski, Director.
Fiume	I. R. Accademia di Marina	Meteorological Observations, May to July.
Hamburg	Deutsche Seewarte	Wetterbericht. By Dr. G. Neumayer, Director.
Kew	Observatory	Results of the Monthly Observations of Magnetic Dip, Horizontal Force, and Declination made at the Kew Observatory, from April, 1869, to March, 1875, inclusive. By the Kew Committee.
London	General Register Office ..	Weekly Return of Births and Deaths, Nos. 26-38.
	" "	Quarterly Return of Marriages, Births, and Deaths, June 30th. By the Registrar-General.
	Institution of Civil Engineers	Rainfall and Evaporation. Papers by G. J. Symons, C. Greaves, and J. Evans, F.R.S.
	Institution of Surveyors.	Library Catalogue. Corrected to September, 1874.
	Meteorological Office	Daily Weather Reports and Charts.
	" "	Hourly Readings from the Self-Recording Instruments at the Seven Observatories in connection with the Meteorological Office, November, 1875, to March, 1876.
	" "	Report of the Meteorological Committee of the Royal Society, for the year ending 31st December, 1875.
	" "	Report of the Meteorological Committee to the President and Council of the Royal Society on the Work done in the Meteorological Office since their appointment in 1866, to December 31st, 1875.
	" "	Contributions to the Meteorology of Japan. By Staff-Commander T. H. Tizard.
	" "	Meteorological Observations taken at Orkney, with Remarks on the Climate. By the Rev. Charles Clouston. By the Meteorological Committee.
	Royal Astronomical Society.....	Monthly Notices, Vol. XXXVI., Nos. 1-8, November, 1875, to June, 1876.

London	Royal Society	Proceedings, Vol. XXIV., No. 170; Vol. XXV., Nos. 171 and 172.
Lyons	Commission de Météorologie.....	Rapport, 1874. By Prof. Lafon, President.
Manchester ..	Manchester and Salford Sanitary Association...	Annual Report of the Committee for 1875.
Melbourne	Observatory	Monthly Record of Results of Observations in Meteorology, Terrestrial Magnetism, &c., December, 1875, to February, 1876. By R. J. Ellery, F.R.S., Government Astronomer.
	Registrar-General's Department	Patents and Patentees, Vol. VIII., 1878. By R. Gibbs, Registrar-General.
Moncalieri	Osservatorio del R. Collegio Carlo Alberto	Bullettino Meteorologico, Vol. VII., Nos. 10-12, Vol. X., No. 4.
	,, ,,	Osservazioni Meteorologiche, Nos. 19-26.
	,, ,,	Sulla Distribuzione della Pioggia in Italia nell' Anno Meteorico 1871-2. Memoria del P. F. Denza. By Padre F. Denza, Director.
New Haven ..	Connecticut Academy of Arts and Sciences	Transactions, Vol. III., Part I.
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Dunlop, W. H.	Results of Meteorological Observations made at Annanhill, Kilmarnock, Ayr, during May to July.
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Forbes, A.	Meteorological Summary, Culloden, June to August. (MS.)
Hamberg, Dr. H. E.....	La Température et l'Humidité de l'Air à différentes hauteurs, observées à Upsal pendant l'été de 1875. Par Dr. H. E. Hamberg.
,, ...	Om utvecklingen af ett barometerminimum atföljdt a[illegible] aakväder i Sverige och Norge dagarne 14-20 Juli 1872. Af H. E. Hamberg.
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Whitmore, J., M.D.	Monthly Report on the Health and Meteorology of the Parish of Saint Marylebone during June and July. By John Whitmore, M.D.
,, ,, ...	Annual Report of Ditto during 1875.

AUDLEY END, ESSEX—*Continued.*

Thermometers 4 feet above ground. Rain-gauge 1 foot above ground.

Months.	Amount of Cloud.			Rainfall.			Weather, No. of Days of							Wind, No. of Observations of								
	9 a.m.	9 p.m.	Mean.	Total.	Max.	Day.	Rain.	Snow.	Hail.	Thunder Storms.	Clear Sky.	Overcast.	Gales.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
				ins.	ins.																	
January - -	7·5	7·5	7·5	2·240	·310	1st & 29th	19	1	0	1	3	19	0	0	4	0	6	15	21	3	6	7
February - -	7·4	6·7	7·1	0·870	·200	11th	13	4	0	0	2	14	0	2	19	4	4	0	8	0	6	13
March - -	7·7	6·1	6·9	0·570	·150	6th	14	5	1	1	3	15	0	4	23	3	5	0	7	2	14	4
April - -	6·1	4·5	5·3	1·090	·460	9th	9	0	0	0	8	9	0	2	15	1	5	0	10	4	10	13
May - -	5·7	2·6	4·1	1·800	·530	7th	10	0	0	4	5	5	0	0	2	3	4	0	24	5	17	7
June - -	5·9	4·4	5·2	2·900	·540	10th	18	0	1	9	4	6	0	1	7	3	2	3	27	3	6	8
July - -	7·8	6·4	7·1	4·940	·850	14th & 21st	18	0	0	3	1	14	0	2	9	1	4	2	7	6	14	17
August - -	7·2	4·1	5·6	1·010	·350	28th	11	0	0	1	0	6	0	7	0	0	0	4	14	1	10	26
September -	6·8	4·2	5 5	3·030	1·000	21st	15	0	0	3	3	9	0	2	6	0	5	0	13	2	10	22
October - -	7·1	6·6	6·9	3·150	·700	2nd	16	0	0	1	3	15	0	0	4	0	16	0	15	3	3	21
November -	7·8	8·2	8·0	3·890	1·020	10th	19	3	0	0	0	19	0	0	9	0	9	1	5	4	15	17
December -	7·8	8·2	8·0	0·960	·210	2nd	16	8	0	0	2	19	0	0	1	0	5	4	14	2	14	22
Year -	7·1	5·8	6·4	26·450	—	—	178	21	2	23	34	150	0	20	99	15	65	29	165	35	125	177

BATH.

Long. 2° 24′ W. Lat. 51° 23′ N. Height above Mean Sea Level, 144 feet.

Months.	Mean Pressure.	Air Temperature.									Tension of Vapour.			Relative Humidity.		
		9 a.m.	9 p.m.	Mean.	Means of		Absolute Min. and Max.				9 a.m.	9 p.m.	Mean.	9 a.m.	9 p.m.	Mean.
					Min.	Max.	Min.	Day.	Max.	Day.						
	ins.	°	°	°	°	°	°		°		in.	in.	in.	%	%	%
January -	29·882	45·2	46·0	45·6	40·1	49·7	**18·6**	**1st**	55·1	14th	·275	·284	·280	89	90	90
February -	30·012	35·1	37·1	36·1	32·5	41·8	25·7	5th	55·5	14th	·189	·206	·197	90	90	90
March - -	·124	42·3	42·3	42·3	36·4	48·5	29·3	16th	57·2	31st	·219	·232	·226	79	83	81
April - -	30·020	49·7	46·4	48·0	39·4	57·4	32·7	14th	73·0	20th	·254	·241	·247	71	75	73
May - -	29·984	57·0	54·9	56·0	46·4	65·1	41·8	11th & 27th	77·5	15th	·351	·356	·354	75	82	78
June - -	·878	60·9	58·8	59·8	50·4	67·5	42·1	22nd	80·8	3rd	·412	·434	·423	76	87	82
July - -	29·981	60·1	60·1	60·1	51·9	68·4	43·0	13th	77·0	29th	·419	·479	·449	81	92	86
August - -	30·075	63·3	63·1	63·2	54·9	71·4	44·2	1st	**82·5**	**16th**	·481	·518	·499	83	90	86
September -	30·005	60·6	60·0	60·3	52·8	67·9	43·8	11th	78·0	18th	·453	·476	·465	86	92	89
October -	29·741	49·2	48·1	48·6	43·6	54·3	35·0	15th	66·7	5th	·324	·327	·325	92	97	94
November -	29·855	42·9	43·7	43·3	38·6	48·6	27·6	26th	60·6	3rd	·254	·275	·265	92	96	94
December -	30·102	39·1	39·5	39·3	35·4	44·1	23·2	5th	55·3	21st	·225	·228	·226	95	94	95
Year -	29·972	50·4	50·0	50·2	43·5	57·1	—	—	—	—	·321	·338	·330	84·1	89·0	86·5

DATA—*Continued.*

Thermometers 4 feet above ground. Rain-gauge 1 foot above ground.

Months.	Amount of Cloud.			Rainfall.			Weather, No. of Days of							Wind, No. of Observations of								
	9 a.m.	9 p.m.	Mean.	Total.	Max.	Day.	Rain.	Snow.	Hail.	Thunder Storms.	Clear Sky.	Overcast.	Gales.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
				ins.	ins.																	
January -	8·0	7·7	7·9	4·990	·880	2nd	24	1	2	1	1	20	10	0	2	2	8	6	19	7	0	18
February -	7·3	7·9	7·6	2·708	·850	25th	13	9	0	0	2	16	7	6	18	8	1	1	6	1	1	14
March - -	7·5	7·2	7·3	1·110	·485	7th	12	5	0	0	4	16	11	3	15	10	1	2	6	8	8	9
April - -	6·2	4·6	5·4	1·699	·330	7th	9	2	4	0	6	10	8	2	16	7	4	1	8	4	3	15
May - -	5·3	3·4	4·4	2·307	·540	6th	15	0	2	1	7	4	6	2	8	2	3	2	14	24	2	5
June - -	6·7	5·5	6·1	3·697	1·025	10th	17	0	3	5	4	9	5	1	3	2	0	3	17	17	3	14
July - -	6·4	5·4	5·9	5·785	2·710	14th	18	0	0	1	2	9	4	6	7	4	3	1	7	7	4	23
August - -	6·6	7·0	6·8	1·262	·450	28th	10	0	0	2	1	13	0	7	2	2	1	6	10	5	6	23
September -	6·8	5·6	6·2	3·802	·850	21st	16	0	1	4	4	10	6	0	7	12	5	2	7	9	4	14
October -	8·5	7·1	7·8	6·542	·950	9th	23	0	0	0	0	19	7	3	4	14	7	2	9	4	10	9
November -	8·1	7·9	8·0	4·443	·770	13th	20	3	1	0	0	19	8	4	11	3	0	4	5	11	6	16
December -	7·9	6·3	7·1	1·466	·380	2nd	14	4	0	0	1	13	6	4	4	0	1	8	6	4	2	33
Year -	7·1	6·3	6·7	39·811	—	—	191	24	13	14	32	158	78	38	97	66	34	38	114	101	49	193

BUXTON.

Long. 1° 54′ W. Lat. 53° 14′ N. Height above Mean Sea Level, 987 feet.

Months.	Mean Pressure.	Air Temperature.									Tension of Vapour.			Relative Humidity.		
		9 a.m.	9 p.m.	Mean.	Means of		Absolute Min. and Max.				9 a.m.	9 p.m.	Mean.	9 a.m.	9 p.m.	Mean.
					Min.	Max.	Min.	Day.	Max.	Day.						
	ins.	°	°	°	°	°	°		°		in.	.in	in.	%	%	%
January -	29·866	39·9	40·7	40·3	35·7	44·9	20·2	1st	51·5	14th	·231	·232	·231	92·1	90·5	91·3
February -	30·105	32·6	33·1	32·9	27·9	37·7	13·5	24th	49·3	14th	·177	·183	·180	94·2	95·6	94·9
March - -	·198	36·7	36·1	36·4	31·9	42·2	22·1	18th	53·9	8th	·195	·198	·197	88·8	91·9	90·4
April - -	*·080	46·3	41·3	43·8	34·8	52·4	23·4	14th	67·9	21st	·230	·216	·223	74·3	83·2	78·8
May - -	*30·011	51·7	47·9	49·8	41·6	59·9	31·5	30th	72·2	14th	·296	·283	·289	77·7	84·5	81·1
June - -	29·902	55·6	51·0	53·3	45·2	61·5	34·5	1st	73·6	3rd	·336	·322	·329	76·3	85·8	81·1
July - -	29·985	*58·1	53·8	*55·9	47·2	63·5	38·8	27th & 28th	72·9	29th	*·371	·363	*·367	*77·0	87·4	*82·2
August - -	30·037	59·2	55·6	57·4	49·7	65·2	39·2	2nd	75·9	16th	·406	·388	·397	81·0	87·5	84·3
September -	30·037	56·4	53·5	55·0	47·8	62·4	38·7	10th	70·6	7th	·386	·370	·378	84·6	89·4	87·0
October -	‡29·754	45·2	43·3	44·2	38·8	50·1	27·0	14th	59·7	1st	·276	·258	·267	90·2	91·4	90·8
November -	29·829	38·4	38·8	38·6	*34·6	43·0	22·8	26th	54·4	5th	·214	·223	·218	89·3	91·6	90·5
December -	30·093	36·9	37·3	37·1	33·6	40·6	22·2	5th	51·9	22nd	·203	·203	·203	91·6	89·4	90·5
Year -	29·991	46·4	44·4	45·4	39·1	51·9	—	—	—	—	·277	·270	·273	84·8	89·0	86·9

* One observation lost. ‡ Three observations lost.

BUXTON—*Continued.*

Thermometers 4 feet above ground. Rain-gauge 1 foot above ground.

Months.	Amount of Cloud.			Rainfall.			Weather, No. of Days of							Wind. No. of Observations of							
	9 a.m.	9 p.m.	Mean.	Total.	Max.	Day.	Rain.	Snow.	Hail.	Thunder Storms.	Clear Sky.	Overcast.	Gales.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
				ins.	ins.																	
January -	7·8	8·7	8·3	5·245	·670	24th	23	6	0	2	0	20	6	3	0	2	8	6	15	20	5	3
February	8·7	8·9	8·8	2·264	·605	11th	12	12	0	0	0	22	4	5	8	15	6	2	4	4	10	2
March - -	8·6	7·9	8·2	0·990	·300	7th	9	6	0	0	1	19	10	6	3	11	15	1	0	9	10	7
April - -	6·2	6·9	6·6	1·610	·465	3rd	7	1	1	0	3	12	1	3	8	13	8	2	5	2	14	5
May - -	7·2	4·4	5·8	3·035	·600	9th	12	0	3	1	2	4	1	8	3	3	3	6	13	17	8	1
June - -	7·4	6·5	6·9	4·095	1·030	3rd	16	0	0	6	1	7	0	7	0	9	4	1	11	16	9	3
July - -	5·8	6·4	6·1	6·188	1·305	19th	17	0	0	3	3	10	1	5	1	13	5	3	2	6	20	7
August -	6·6	5·7	6·2	5·280	1·510	7th	16	0	0	4	1	9	1	1	3	7	4	1	3	19	18	6
September -	6·8	6·4	6·6	7·122	1·220	8th	16	0	0	2	2	10	4	1	2	6	12	1	5	11	11	11
October -	8·3	6·7	7·5	6·662	1·420	19th	21	0	0	0	0	14	3	1	5	11	11	3	3	10	12	6
November -	7·4	8·0	7·7	6·575	1·040	6th	23	14	3	0	1	18	5	6	9	12	4	1	11	8	7	2
December -	8·2	8·0	8·1	2·700	·615	21st	14	6	0	0	0	17	4	3	6	3	0	0	9	21	16	4
Year -	7·4	7·0	7·2	51·766	—	—	186	45	7	18	14	162	40	49	48	105	80	27	81	143	140	57

CALCETHORPE.

Long. 0° 7′ W. Lat. 53° 23′ N. Height above Mean Sea Level 379 feet.

nths.	Mean Pressure.	Air Temperature.									Tension of Vapour.			Relative Humidity.		
		9 a.m.	9 p.m.	Mean.	Means of.		Absolute Min. and Max.				9 a.m.	9 p.m.	Mean.	9 a.m.	9 p.m.	Mean.
					Min.	Max.	Min.	Day.	Max.	Day.						
	ins.	°	°	°	°	°	°		°		in.	in.	in.	%	%	%
January - -	29·872	39·1	39·8	39·5	35·1	44·6	7·0	1st	52·1	14th	·226	·232	·229	93·0	93·3	93·2
February - -	30·087	33·5	34·1	33·8	31·4	38·3	23·3	6th	51·0	14th	·172	·175	·173	88·2	87·4	87·8
March - -	·173	38·7	37·6	38·1	33·8	43·8	27·9	5th	55·8	8th	·204	·201	·203	85·2	87·3	86·3
April - -	30·064	45·5	42·1	43·8	37·5	52·8	29·6	18th	68·0	20th	·254	·236	·245	83·0	87·8	85·4
May - -	29·996	53·9	49·1	51·5	43·1	60·8	35·8	3rd	72·9	14th	·314	·298	·306	75·8	84·8	80·3
June - -	·892	58·2	53·3	55·8	47·3	64·5	40·1	1st	76·0	4th	·355	·339	·347	73·3	83·7	78·5
July - -	29·986	58·3	54·3	56·3	50·2	63·6	41·5	13th	71·3	19th	·392	·383	·387	80·2	90·2	85·2
August - -	30·033	60·6	57·5	59·0	52·8	67·8	44·0	2nd	80·8	16th	·421	·415	·418	79·7	86·9	83·3
September -	30·047	57·8	54·7	56·3	50·8	63·7	41·4	29th	71·6	7th	·406	·383	·395	84·5	88·8	86·7
October - -	29·797	47·8	46·2	47·0	42·7	52·7	32·9	13th	64·4	4th	·294	·285	·289	87·6	89·9	88·8
November -	29·806	40·0	39·5	39·7	36·0	44·4	27·4	26th	54·5	18th	·223	·227	·225	88·1	90·9	89·5
December -	30·082	37·2	37·8	37·5	34·5	41·1	25·1	5th	53·5	22nd	·202	·209	·206	89·6	89·8	89·7
Year -	29·986	47·6	45·5	46·5	41·3	53·2	—	—	—	—	·289	·282	·285	84·0	88·4	86·2

CALCETHORPE—*Continued.*

Thermometers 4 feet above ground. Rain-gauge 10 inches above ground.

Months.	Amount of Cloud.			Rainfall.			Weather, No. of Days of.							Wind, No. of Observations of.								
	9 a.m.	9 p.m.	Mean.	Total.	Max.	Day.	Rain.	Snow.	Hail.	Thunder-storms.	Clear Sky.	Overcast.	Gales.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
				ins.	ins.																	
January - -	7·9	6·9	7·4	2·185	·264	24th	23	2	0	0	1	17	2	2	1	1	7	16	30	4	1	0
February - -	8·2	7·7	8·0	1·378	·256	11th	16	9	1	0	0	20	1	6	9	14	5	4	3	7	3	5
March - -	8·6	6·9	7·7	0·653	·247	6th	14	5	2	0	1	19	1	12	9	14	2	2	8	6	6	3
April - -	6·4	5·3	5·9	0·733	·163	7th	9	0	1	0	5	10	1	5	12	4	5	8	10	6	4	6
May - -	6·7	4·5	5·6	1·436	·223	18th	15	0	0	3	3	7	0	6	3	5	6	9	17	11	2	3
June - -	6·6	5·8	6·2	3·142	1·614	29th	17	0	0	8	2	9	0	1	9	3	2	7	27	6	2	3
July - -	7·6	7·0	7·3	5·228	1·359	17th	19	0	0	3	2	17	1	6	13	13	5	3	9	7	3	3
August - -	7·6	5·7	6·6	3·649	1·503	12th	16	0	0	4	0	11	0	10	7	5	4	3	22	7	3	1
September -	7·0	4·4	5·7	1·935	·600	21st	17	0	0	1	4	6	1	1	12	10	5	9	12	7	1	3
October - -	7·7	6·2	7·0	5·428	1·288	20th	20	0	0	0	2	14	1	4	2	17	10	5	13	8	1	2
November -	7·9	8·0	7·9	5·756	·744	13th	25	8	2	0	0	19	1	7	13	8	5	6	8	10	3	0
December -	8·0	6·7	7·4	1·317	·242	5th	20	7	3	0	3	15	1	1	9	2	0	6	23	12	8	1
Year -	7·5	6·3	6·9	32·840	—	—	211	31	9	19	23	164	10	61	99	96	56	78	182	91	37	30

CARMARTHEN.

Long. 4° 18′ W. Lat. 51° 52′ N. Height above Mean Sea Level, 188 feet.

Months.	Mean Pressure.	Air Temperature.									Tension of Vapour.			Relative Humidity.		
		9 a.m.	9 p.m.	Mean.	Means of		Absolute Min. and Max.				9 a.m.	9 p.m.	Mean.	9 a.m.	9 p.m.	Mean.
					Min.	Max.	Min.	Day.	Max.	Day.						
	ins.	°	°	°	°	°	°		°		in.	in.	in.	%	%	%
January - -	29·833	45·2	45·8	45·5	*42·1	*49·5	30·0	1st	53·4	15th & 30th	·288	·292	·290	94·5	93·6	94·1
February - -	30·036	37·8	37·4	37·6	34·2	43·6	25·3	24th	53·2	12th	·205	·206	·205	87·0	89·5	88·3
March - -	·150	42·8	40·7	41·8	36·4	48·3	27·8	21st	57·8	31st	·228	·222	·225	81·4	85·9	83·7
April - -	30·027	50·2	46·1	48·1	39·1	56·8	30·7	23rd	71·5	20th	·274	·268	·271	76·3	86·3	81·3
May - -	29·987	56·5	51·0	53·8	46·4	61·9	40·2	19th	74·2	14th	·360	·335	·348	79·2	89·7	84·5
June - -	·881	58·5	53·8	56·1	49·6	64·1	43·9	19th	75·5	2nd	·399	·385	·392	81·6	92·7	87·2
July - -	29·969	60·8	56·5	58·7	51·5	67·0	40·6	26th	76·3	7th	·434	·420	·427	81·8	91·9	86·9
August - -	*30·018	62·5	58·1	60·3	53·2	*69·5	44·3	5th	73·2	8th	·495	·474	·484	88·3	97·2	92·8
September -	29·993	60·3	57·8	59·0	53·1	†67·8	43·7	9th	75·2	7th	·458	·450	·454	87·8	93·4	90·6
October - -	*·733	50·5	*48·5	*49·5	*43·7	*56·1	32·0	16th	64·2	1st	·319	*·305	*·312	85·5	*88·1	*86·8
November -	*29·811	43·4	43·2	43·3	39·1	50·2	23·3	27th	60·6	3rd	·247	·255	·251	84·5	86·4	85·5
December -	*30·111	40·1	40·3	40·2	36·1	45·7	23·1	6th	54·9	22nd	·237	·239	·238	92·2	92·5	92·4
Year -	29·962	50·7	48·3	49·5	43·7	56·7	—	—	—	—	·329	·321	·325	85·0	90·6	87·8

* One observation lost. † Two observations lost.

CALCETHORPE—*Continued.*

Thermometers 4 feet above ground. Rain-gauge 10 inches above ground.

Months.	Amount of Cloud.			Rainfall.			Weather, No. of Days of.							Wind, No. of Observations of.								
	9 a.m.	9 p.m.	Mean.	Total.	Max.	Day.	Rain.	Snow.	Hail.	Thunder-storms.	Clear Sky.	Overcast.	Gales.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
				ins.	ins.																	
January - -	7·9	6·9	7·4	2·185	·264	24th	23	2	0	0	1	17	2	2	1	1	7	16	30	4	1	0
February - -	8·2	7·7	8·0	1·378	·256	11th	16	9	1	0	0	20	1	6	9	14	5	4	3	7	3	5
March - -	8·6	6·9	7·7	0·653	·247	6th	14	5	2	0	1	19	1	12	9	14	2	2	8	6	6	3
April - -	6·4	5·3	5·9	0·733	·163	7th	9	0	1	0	5	10	1	5	12	4	5	8	10	6	4	6
May - -	6·7	4·5	5·6	1·436	·223	18th	15	0	0	3	3	7	0	6	3	5	6	9	17	11	2	3
June - -	6·6	5·8	6·2	3·142	1·614	29th	17	0	0	8	2	9	0	1	9	3	2	7	27	6	2	3
July - -	7·6	7·0	7·3	5·228	1·359	17th	19	0	0	3	2	17	1	6	13	13	5	3	9	7	3	3
August - -	7·6	5·7	6·6	3·649	1·503	12th	16	0	0	4	0	11	0	10	7	5	4	3	22	7	3	1
September -	7·0	4·4	5·7	1·935	·600	21st	17	0	0	1	4	6	1	1	12	10	5	9	12	7	1	3
October - -	7·7	6·2	7·0	5·428	1·288	20th	20	0	0	0	2	14	1	4	2	17	10	5	13	8	1	2
November -	7·9	8·0	7·9	5·756	·744	13th	25	8	2	0	0	19	1	7	13	8	5	6	8	10	3	0
December -	8·0	6·7	7·4	1·317	·242	5th	20	7	3	0	3	15	1	1	9	2	0	6	23	12	8	1
Year -	7·5	6·3	6·9	32·840	—	—	211	31	9	19	23	164	10	61	99	96	56	78	182	91	37	30

CHEADLE, STAFFORD.

Long. 1° 57′ W. Lat. 52° 28′ N. Height above Mean Sea Level, 646 feet.

Months.	Mean Pressure.	Air Temperature.									Tension of Vapour.			Relative Humidity.		
		9 a.m.	9 p.m.	Mean.	Means of		Absolute Min. and Max.				9 a.m.	9 p.m.	Mean.	9 a.m.	9 p.m.	Mean.
					Min.	Max.	Min.	Date.	Max.	Date.						
	ins.	°	°	°	°	°	°		°		in.	in.	in.	%	%	%
January - -	29·831	39·9	40·8	40·4	36·3	44·7	13·4	1st	51·5	19th	·232	·239	·236	92	92	92
February - -	30·059	33·5	34·0	33·8	30·6	38·4	22·2	9th	50·0	14th	·170	·174	·172	86	87	86
March - -	·167	38·5	37·7	38·1	34·1	44·7	27·0	5th	54·4	8th	·203	·200	·201	85	86	86
April - -	30·063	45·8	43·8	44·8	38·1	53·8	30·2	14th	68·0	20th	·226	·224	·225	73	78	76
May - -	29·998	52·1	49·4	50·7	43·3	60·0	37·0	30th	71·8	14th	·301	·284	·293	77	79	78
June - -	·890	55·9	53·0	54·5	48·0	62·7	41·8	13th	76·0	3rd	·342	·336	·339	77	83	80
July - -	29·988	57·2	54·9	56·0	49·8	64·2	42·2	13th & 26th	73·5	29th	·373	·365	·369	79	85	82
August - -	30·036	59·1	57·8	58·5	52·1	66·3	42·7	5th	77·8	16th	·408	·405	·406	81	85	83
September -	30·032	56·2	55·1	55·7	50·4	62·9	42·2	29th	74·2	19th	·393	·385	·389	87	89	88
October - -	29·782	45·6	44·8	45·2	41·0	51·7	32·2	12th	63·3	4th	·280	·271	·276	92	91	91
November -	29·807	38·9	39·8	39·3	35·7	44·6	26·0	26th	57·9	4th	·217	·227	·222	92	93	93
December -	30·096	37·0	37·9	37·5	34·0	41·3	23·0	6th	53·1	22nd	·200	·206	·203	91	90	90
Year -	29·979	46·6	45·8	46·2	41·1	52·9	—	—	—	—	·279	·276	·278	84·3	86·5	85·4

CARMARTHEN—*Continued.*

Thermometers 4 feet above ground. Rain-gauge 1 foot above ground.

Months.	Amount of Cloud.			Rainfall.			Weather, No. of Days of							Wind, No. of Observations of								
	9 a.m.	9 p.m.	Mean.	Total.	Max.	Day.	Rain.	Snow.	Hail.	Thunder Storms.	Clear Sky.	Overcast.	Gales.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
				ins.	ins.																	
January - -	8·3	9·2	8·8	9·330	·800	24th	30	0	3	1	0	21	1	0	1	3	11	11	20	6	2	8
February - -	7·5	7·5	7·5	2·520	·780	6th	11	2	0	0	2	16	0	4	16	13	4	2	3	1	0	13
March - -	6·9	6·8	6·8	1·450	·400	7th	11	1	0	0	4	12	0	10	4	23	4	2	6	0	4	9
April - -	6·0	*4·9	*5·4	3·160	·890	4th	10	0	2	0	8	11	0	2	11	14	10	2	7	6	2	6
May - -	6·4	4·1	5·3	3·270	·620	19th	16	0	0	0	4	6	0	8	6	3	4	5	19	7	2	8
June - -	7·2	5·5	6·3	3·370	·570	13th	18	0	0	0	3	12	0	6	1	4	1	5	23	4	6	10
July - -	6·3	5·4	5·9	6·400	2·770	14th	13	0	0	1	6	12	0	*16	8	2	5	0	11	4	6	9
August - -	6·4	5·5	5·9	5·930	1·460	6th	16	0	0	4	4	8	0	*4	3	2	2	2	14	3	2	29
September -	6·3	6·2	6·3	6·170	1·850	2nd	18	0	0	2	6	12	1	1	2	16	5	1	9	5	5	16
October - -	7·7	8·0	7·8	6·450	1·040	21st	25	0	0	0	0	18	0	†2	8	15	6	3	7	6	7	6
November -	*7·9	7·0	*7·5	7·370	1·370	13th	19	0	1	0	2	18	1	3	14	8	6	1	6	9	7	6
December -	7·2	†8·1	†7·6	3·960	1·040	21st	15	1	1	1	1	15	0	3	3	6	5	4	13	5	3	20
Year -	7·0	6·5	6·8	59·380	—	—	202	4	7	9	40	161	3	59	77	109	63	38	138	56	46	140

* One observation lost. † Two observations lost.

CROWBOROUGH BEACON, SUSSEX.

Long. 0° 10′ E. Lat. 51° 3′ N. Height above Mean Sea Level, 776 feet.

Months.	Mean Pressure.	Air Temperature.									Tension of Vapour.			Relative Humidity.		
		9 a.m.	9 p.m.	Mean.	Means of		Absolute Min. and Max.				9 a.m.	9 p.m.	Mean.	9 a.m.	9 p.m.	Mean.
					Min.	Max.	Min.	Day.	Max.	Day.						
	ins.	°	°	°	°	°	°		°		in.	in.	in.	%	%	%
January - -	29·978	41·7	40·7	41·2	37·3	44·9	22·3	1st	49·7	28th	·252	·247	·249	94	95	94
February - -	30·053	33·2	33·3	33·2	30·0	37·4	22·1	23rd	47·1	1st & 15th	·179	·180	·180	93	93	93
March - -	·170	38·8	37·8	38·3	33·6	43·4	26·6	19th	54·9	27th	·202	·198	·200	83	85	84
April - -	·071	46·9	42·0	44·5	38·4	52·9	31·6	24th	76·8	21st	·239	·226	·232	73	84	79
May - -	30·044	55·4	49·6	52·5	45·3	60·6	38·2	31st	74·2	15th	·326	·310	·318	73	86	79
June - -	29·946	58·4	53·2	55·8	48·7	63·6	44·4	17th	77·5	3rd	·385	·367	·376	78	90	84
July - -	29·979	59·4	55·2	57·3	51·5	63·9	45·3	13th	72·4	29th	·405	·393	·399	80	90	85
August - -	30·066	62·1	57·5	59·8	54·0	67·7	45·6	5th	77·6	16th	·440	·430	·435	79	91	85
September -	30·060	60·0	56·2	58·1	52·5	65·3	45·4	29th	75·7	18th	·432	·414	·423	83	91	87
October - -	29·810	48·8	45·8	47·3	42·7	52·1	37·0	12th	62·6	4th	·309	·296	·303	90	96	93
November -	29·817	40·7	41·0	40·8	36·8	45·2	26·0	30th	55·1	18th	·237	·246	·241	93	96	94
December -	30·145	37·0	36·7	36·9	33·4	39·4	20·4	6th	50·1	22nd	·210	·213	·212	95	98	97
Year -	30·012	48·5	45·7	47·1	42·0	53·0	—	—	—	—	·301	·293	·297	84·5	91·2	87·8

CROWBOROUGH BEACON, SUSSEX—*Continued.*

Thermometers 4 feet above ground. Rain-gauge 1 foot above ground.

Months.	Amount of Cloud.			Rainfall.			Weather, No. of Days of							Wind, No. of Observations of								
	9 a.m.	9 p.m.	Mean.	Total.	Max.	Day.	Rain.	Snow.	Hail.	Thunder Storms.	Clear Sky.	Overcast.	Gales.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
				ins.	ins.																	
January - -	8·4	8·0	8·2	5·000	·570	29th	21	3	1	1	2	19	2	3	0	1	18	22	13	4	1	0
February - -	7·1	7·4	7·2	1·440	·460	11th	11	8	1	0	3	14	0	19	10	5	3	9	1	1	6	2
March - -	7·6	8·7	8·2	1·140	·390	7th	6	7	0	0	1	21	1	19	13	3	1	5	5	4	8	4
April - -	6·6	4·4	5·5	1·240	·460	8th	8	0	0	0	8	10	0	20	9	6	2	9	8	5	1	0
May - -	6·4	3·6	5·0	1·830	·600	1st	10	0	1	2	5	8	0	7	6	2	3	15	10	4	6	9
June - -	6·6	5·7	6·1	3·720	·840	30th	13	0	2	5	3	13	0	5	3	0	4	19	16	4	2	7
July - -	7·3	7·6	7·5	6·010	1·380	14th	17	0	0	5	3	19	0	15	8	3	2	6	9	10	2	7
August - -	8·1	5·3	6·7	2·160	1·320	28th	8	0	0	3	1	11	0	13	2	2	3	17	13	6	2	4
September -	6·5	5·4	5·9	2·070	·630	21st	11	0	0	2	4	10	0	5	10	9	7	11	7	8	1	2
October - -	7·5	6·5	7·0	5·540	·880	1st	17	0	0	1	3	17	0	8	11	9	5	9	13	5	2	0
November -	8·2	8·4	8·3	5·140	·900	10th	17	5	1	0	1	20	1	11	9	4	6	4	8	10	6	2
December -	8·4	8·1	8·3	1·940	·450	21st	13	6	0	0	2	22	1	12	1	3	8	9	9	6	9	5
Year -	7·4	6·6	7·0	37·230	—	—	152	29	6	19	36	184	5	137	82	47	62	135	112	67	46	42

CROWBOROUGH BEACON, SUSSEX.

Long. 0° 10′ E. Lat. 51° 3′ N. Height above Mean Sea Level, 776 feet.

Months.	Mean Pressure.	Air Temperature.									Tension of Vapour.			Relative Humidity.		
		9 a.m.	9 p.m.	Mean.	Means of		Absolute Min. and Max.				9 a.m.	9 p.m.	Mean.	9 a.m.	9 p.m.	Mean.
					Min.	Max.	Min.	Day.	Max.	Day.						
	ins.	°	°	°	°	°	°		°		in.	in.	in.	%	%	%
January - -	29·978	41·7	40·7	41·2	37·3	44·9	22·3	1st	49·7	28th	·252	·247	·249	94	95	94
February - -	30·053	33·2	33·3	33·2	30·0	37·4	22·1	23rd	47·1	1st & 15th	·179	·180	·180	93	93	93
March - -	·170	38·8	37·8	38·3	33·6	43·4	26·6	19th	54·9	27th	·202	·198	·200	83	85	84
April - -	·071	46·9	42·0	44·5	38·4	52·9	31·6	24th	76·8	21st	·239	·226	·232	73	84	79
May - -	30·044	55·4	49·6	52·5	45·3	60·6	38·2	31st	74·2	15th	·326	·310	·318	73	86	79
June - -	29·946	58·4	53·2	55·8	48·7	63·6	44·4	17th	77·5	3rd	·385	·367	·376	78	90	84
July - -	29·979	59·4	55·2	57·3	51·5	63·9	45·3	13th	72·4	29th	·405	·393	·399	80	90	85
August - -	30·066	62·1	57·5	59·8	54·0	67·7	45·6	5th	77·6	16th	·440	·430	·435	79	91	85
September -	30·060	60·0	56·2	58·1	52·5	65·3	45·4	29th	75·7	18th	·432	·414	·423	83	91	87
October - -	29·810	48·8	45·8	47·3	42·7	52·1	37·0	12th	62·6	4th	·309	·296	·303	90	96	93
November -	29·817	40·7	41·0	40·8	36·8	45·2	26·0	30th	55·1	18th	·237	·246	·241	93	96	94
December -	30·145	37·0	36·7	36·9	33·4	39·4	20·4	6th	50·1	22nd	·210	·213	·212	95	98	97
Year -	30·012	48·5	45·7	47·1	42·0	53·0	—	—	—	—	·301	·293	·297	84·5	91·2	87·8

DARTMOOR—*Continued.*

Thermometers 4 feet above ground. Rain-gauge 1 foot above ground

Months	Amount of Cloud.			Rainfall.			Weather, No. of Days of							Wind, No. of Observations of								
	9 a.m.	9 p.m.	Mean.	Total.	Max.	Day.	Rain.	Snow.	Hail.	Thunder Storms.	Clear sky.	Overcast.	Gales.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
				ins.	ins.																	
January - -	9·4	9·4	9·4	16·850	2·010	13th	29	1	1	1	0	26	8	1	0	2	7	13	20	11	6	2
February - -	8·4	7·6	8·0	4·710	1·800	11th	17	8	0	0	2	19	5	1	5	26	3	2	4	5	4	6
March - -	8·0	6·3	7·2	3·630	1·530	7th	12	3	0	0	1	17	10	4	10	20	3	2	3	6	13	1
April - -	6·6	4·0	5·3	2·950	·950	4th	13	2	1	0	6	11	2	2	7	21	6	0	3	6	6	9
May - -	6·2	4·3	5·2	4·690	·920	6th	15	0	1	0	6	10	3	9	7	0	2	6	12	6	12	8
June - -	8·1	7·4	7·8	7·650	1·220	11th	21	0	1	2	1	17	1	1	2	7	0	4	12	15	19	0
July - -	7·3	6·5	6·9	7·960	4·150	14th	17	0	1	0	3	15	3	2	15	3	5	2	7	7	14	7
August - -	7·5	6·7	7·1	5·040	·790	10th	19	0	0	2	2	15	0	0	8	5	0	3	8	18	9	11
September -	7·9	5·9	6·9	7·970	2·000	21st	21	0	0	2	0	13	8	0	1	15	6	5	8	9	5	11
October - -	8·2	7·4	7·8	9·870	1·310	18th	27	0	2	0	0	15	5	2	5	3	11	4	10	5	9	3
November -	7·9	7·5	7·7	10·190	1·890	13th	21	0	0	1	0	16	9	3	16	3	6	4	4	6	13	5
December -	8·3	7·4	7·8	4·160	·940	21st	18	4	0	0	0	19	6	3	12	5	0	11	10	8	3	10
Year -	7·8	6·7	7·3	85·670	—	—	230	18	7	8	21	193	60	28	88	110	49	56	101	102	113	83

HAWES.

Long. 2° 11′ W. Lat. 54° 18′ N. Height above Mean Sea Level, 800 feet.

Months.	Mean Pressure.	Air Temperature.									Tension of Vapour.			Relative Humidity.		
		9 a.m.	9 p.m.	Mean.	Means of		Absolute Min. and Max.				9 a.m.	9 p.m.	Mean.	9 a.m.	9 p.m.	Mean.
					Min.	Max.	Min.	Day.	Max.	Day.						
	ins.	°	°	°	°	°	°		°		in.	in.	in.	%	%	%
January - -	29·810	*40·2	†40·7	‡40·5	35·3	44·2	5·5	1st	49·5	14th, 15th, & 19th	*·240	†·242	‡·241	*95·0	†94·2	‡94·6
February - -	30·109	33·3	33·1	33·2	30·4	37·8	21·5	5th	48·3	14th	·163	·166	·165	82·8	86·4	84·6
March - -	·188	37·1	36·6	36·9	32·8	42·5	24·0	21st	51·0	31st	·186	·189	·187	82·8	84·9	83·9
April - -	30·073	45·4	41·5	43·4	36·1	53·2	26·3	25th	69·8	20th	·236	·222	·229	78·2	84·0	81·1
May - -	29·977	51·2	47·7	49·5	41·5	57·9	30·8	30th	69·8	14th	·293	·284	·288	78·0	85·2	81·6
June - -	29·877	54·9	50·4	52·6	45·1	60·3	34·7	2nd	73·0	3rd	·327	·323	·325	76·0	88·1	82·1
July - -	30·003	58·5	54·1	56·3	47·9	65·0	37·4	26th	75·7	7th	·360	·356	·358	73·6	84·7	79·2
August - -	·031	58·1	55·0	56·6	50·8	63·9	37·6	2nd	74·2	16th	·399	·389	·394	82·5	89·4	86·0
September -	30·038	56·2	52·2	54·2	47·4	62·9	37·4	10th	72·0	11th	·370	·353	·362	81·8	89·8	85·8
October - -	29·790	45·2	43·9	44·5	40·3	49·7	25·8	13th	63·0	1st	·271	·266	·268	89·0	91·8	90·4
November -	29·837	38·5	37·7	38·1	34·0	42·5	24·0	9th	54·3	5th	·214	·211	·213	88·3	90·1	89·2
December -	30·067	37·2	37·9	37·6	33·9	40·7	18·6	15th	51·7	22nd	·201	·206	·203	88·0	87·7	87·9
Year -	29·983	46·3	44·2	45·3	39·6	51·7	—	—	—	—	·272	·267	·269	83·0	88·0	85·5

* One observation lost. † Two observations lost. ‡ Three observations lost.

HAWES—*Continued.*

Thermometers 4 feet above ground. Rain-gauge 1 foot above ground.

Months.	Amount of Cloud.			Rainfall.			Weather, No. of Days of							Wind, No. of Observations of.								
	9 a.m.	9 p.m.	Mean.	Total.	Max.	Day.	Rain.	Snow.	Hail.	Thunder Storms.	Clear Sky.	Overcast.	Gales.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
				ins.	ins.																	
January - -	9·1	8·7	8·9	10·060	1·790	18th	25	3	1	1	0	26	1	0	0	5	7	5	21	9	4	11
February - -	9·2	7·5	8·4	1·390	·270	11th	17	15	0	0	0	18	0	3	0	17	0	1	4	1	1	29
March - -	9·7	8·2	8·9	1·660	·540	8th	15	10	1	0	0	24	0	1	4	17	2	1	9	5	3	20
April - -	7·1	5·3	6·2	2·160	·720	3rd	9	1	1	1	5	13	1	0	4	6	0	1	7	7	1	34
May - -	7·9	6·6	7·2	2·960	·510	20th	20	0	1	2	1	16	0	0	1	3	2	3	20	7	4	22
June - -	7·3	6·6	7·0	4·390	·750	15th	20	0	0	1	3	11	0	0	2	4	2	1	15	20	2	14
July - -	6·2	6·8	6·5	3·610	·600	1st & 19th	18	0	0	1	4	11	0	2	6	9	2	0	4	13	5	21
August - -	8·7	7·2	7·9	4·120	1·260	9th	19	0	0	3	1	19	0	2	3	8	0	2	13	15	2	17
September -	6·7	6·3	6·5	5·130	1·350	8th	18	0	1	3	6	14	1	0	0	16	3	5	6	14	1	15
October - -	8·6	8·2	8·4	5·650	1·020	19th	24	0	0	0	1	22	0	0	2	20	6	3	7	12	3	9
November -	7·6	6·8	7·2	7·810	2·470	13th	29	13	0	0	4	15	0	5	10	15	3	1	8	13	2	3
December -	8·6	7·7	8·2	5·660	1·700	21st	26	8	2	1	1	19	0	2	7	4	1	2	19	16	3	8
Year -	8·1	7·2	7·6	54·600	—	—	240	50	7	13	26	208	3	15	39	124	28	25	133	132	31	203

HILLINGTON, NORFOLK.

Long. 0° 33′ E. Lat. 52° 48′ N. Height above Mean Sea Level, 89 feet.

Months.	Mean Pressure.	Air Temperature.									Tension of Vapour.			Relative Humidity.		
		9 a.m.	9 p.m.	Mean.	Means of		Absolute Min. and Max.				9 a.m.	9 p.m.	Mean.	9 a.m.	9 p.m.	Mean.
					Min.	Max.	Min.	Day.	Max.	Day.						
	ins.	°	°	°	°	°	°		°		in.	in.	in.	%	%	%
January - -	29·872	41·1	41·1	41·1	35·5	46·4	7·0	1st	54·9	18th & 20th	—	—	—	—	—	—
February - -	30·049	35·2	35·2	35·2	31·2	39·6	23·5	6th	52·0	14th	—	—	—	—	—	—
March - -	·122	40·7	38·7	39·7	33·6	47·2	26·9	10th	60·2	8th	·208	·205	·206	82	87	85
April - -	·054	47·8	43·1	45·5	36·6	55·8	25·2	24th	71·5	20th	·243	·229	·236	73	82	78
May - -	30·016	57·1	50·6	53·8	42·4	63·9	33·2	17th	77·7	15th	·327	·309	·318	70	84	77
June - -	29·906	61·6	55·8	58·7	47·9	71·2	37·1	27th	82·1	3rd	·396	·375	·386	72	84	78
July - -	29·978	60·9	55·3	58·1	50·1	67·0	38·7	13th	76·5	29th	·434	·407	·420	81	93	87
August - -	30·047	64·4	58·1	61·3	52·2	73·0	44·1	3rd & 4th	86·2	16th	·479	·437	·458	79	90	85
September -	30·053	61·4	55·8	58·6	50·6	68·9	44·1	29th	81·9	19th	·449	·413	·431	82	93	88
October - -	29·794	49·4	46·2	47·8	41·5	55·7	29·6	14th	65·9	1st	·317	·281	·299	90	90	90
November -	29·827	41·6	40·5	41·0	35·9	47·2	26·2	26th	57·8	18th	·238	·235	·237	90	93	92
December -	30·076	37·8	38·3	38·1	34·0	43·1	18·9	4th	56·2	22nd	·209	·215	·212	92	93	92
Year -	29·983	49·9	46·6	48·2	41·0	56·6	—	—	—	—	—	—	—	—	—	—

HILLINGTON, NORFOLK—*Continued.*

Thermometers 4 feet above ground. Rain-gauge 1 foot above ground.

Months.	Amount of Cloud.			Rainfall.			Weather, No. of Days of							Wind, No. of observations of								
	9 a.m	9 p.m.	Mean.	Total.	Max.	Day.	Rain.	Snow.	Hail.	Thunder Storms.	Clear Sky.	Overcast.	Gales.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
				ins.	ins.																	
January - -	8·1	7·7	7·9	2·158	·350	1st	18	1	0	0	1	18	7	1	1	0	15	6	26	4	7	2
February - -	8·5	7·6	8·0	1·405	·385	11th	11	8	0	0	1	18	2	4	9	12	11	1	9	1	8	1
March - -	7·4	6·8	7·1	0·570	·108	20th	11	6	0	0	2	14	3	7	11	13	7	0	9	4	8	3
April - -	8·0	7·4	7·7	0·586	·230	8th	5	0	0	0	0	15	1	0	26	1	5	2	13	3	9	1
May - -	6·3	4·5	5·4	1·273	·300	7th	11	0	0	5	3	8	2	2	6	5	5	7	17	7	12	1
June - -	6·6	4·8	5·7	2·415	·620	30th	16	0	0	6	4	7	3	2	3	6	6	3	24	6	7	3
July - -	8·5	7·8	8·2	6·825	2·160	20th	17	0	0	8	0	18	1	3	13	5	3	7	10	9	10	2
August - -	7·4	4·8	6·1	0·999	·352	28th	9	0	0	3	2	8	1	5	10	1	5	2	22	6	10	1
September -	6·9	5·1	6·0	2·170	·685	21st	12	0	0	2	3	9	0	0	16	5	11	2	9	6	7	4
October - -	6·7	7·0	6·8	2·350	·290	1st	17	0	1	0	3	14	5	1	5	7	22	3	12	7	4	1
November -	7·7	8·8	8·3	5·293	·890	13th	24	5	1	0	0	18	6	1	11	8	10	4	10	4	12	0
December -	7·9	7·8	7·8	1·880	·630	2nd	14	8	0	0	1	20	2	0	7	1	2	4	27	6	12	3
Year -	7·5	6·7	7·1	27·924	—	—	165	28	2	24	20	167	33	26	118	64	102	41	188	63	106	22

LLANDUDNO.

Long. 3° 50′ W. Lat. 53° 20′ N. Height above Mean Sea Level, 89 feet.

Months.	Mean Pressure.	Air, Temperature.									Tension of Vapour.			Relative Humidity.		
		9 a.m.	9 p.m.	Mean.	Means of.		Absolute Min and Max.				a.m.	9 p.m.	Mean.	9 a.m.	9 p.m.	Mean.
					Min.	Max.	Min.	Date.	Max.	Date.						
	ins.	°	°	°	°	°	°		°		in.	in.	in.	%	%	%
January - -	29·793	45·3	45·7	45·5	41·0	51·6	25·7	1st	61·8	19th	·259	·259	·259	86	85	86
February - -	30·073	38·9	38·7	38·8	35·5	43·2	29·5	10th	55·5	13th	·201	·204	·202	85	87	86
March - -	·178	42·3	41·4	41·9	37·6	47·8	30·9	20th	56·6	8th	·218	·210	·214	81	80	80
April - -	30·050	51·1	46·2	48·6	41·8	56·8	35·0	14th	70·0	19th	·250	·237	·244	67	76	72
May - -	29·980	56·2	51·4	53·8	47·5	63·1	38·5	1st	72·9	14th	·317	·307	·312	70	81	75
June - -	29·859	59·6	55·2	57·4	51·1	65·9	45·4	1st & 2nd	74·9	3rd	·356	·346	·351	70	79	75
July - -	29·998	60·8	56·4	58·6	52·6	66·9	47·2	13th	77·0	29th	·374	·374	·374	70	82	76
August - -	30·019	63·8	59·4	61·6	55·5	69·0	47·5	20th	76·2	12th	·427	·422	·424	72	83	77
September -	30·002	60·5	58·1	59·3	54·0	66·3	47·7	11th	78·0	7th	·397	·406	·402	75	84	80
October - -	29·749	50·2	49·1	49·6	45·3	55·1	36·4	14th	66·5	1st	·293	·285	·289	80	82	81
November -	29·811	44·2	44·0	44·1	40·5	48·3	32·8	27th	61·1	3rd	·239	·241	·240	82	84	83
December -	*30·067	43·1	*42·8	*43·0	38·5	47·8	28·6	5th	58·0	20th	·227	*·226	*·227	82	*82	*82
Year -	29·965	51·3	49·0	50·2	45·1	56·8	—	—	—	—	·297	·293	·295	76·7	82·2	79·4

* Four p.m. observations lost, 8th, 15th, 16th, and 22nd.

LLANDUDNO—*Continued.*

Thermometers 4 feet above ground. Rain-gauge 1 foot above ground.

Months.	Amount of Cloud.			Rainfall.			Weather, No. of Days of.							Wind, No. of Observations of.								
	9 a.m.	9 p.m.	Mean.	Total.	Max.	Day.	Rain.	Snow.	Hail.	Thunder Storms.	Clear Sky.	Overcast.	Gales	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
				ins.	ins.																	
January - -	7·6	7·3	7·4	3·028	·414	19th	21	1	1	0	1	17	0	1	0	2	2	17	21	16	3	0
February - -	7·3	6·9	7·1	2·137	·436	20th	16	5	0	0	4	14	0	3	8	18	0	9	5	11	2	0
March - -	7·6	7·0	7·3	0·890	·210	25th	9	2	0	0	4	17	0	5	2	15	8	4	8	11	9	0
April - -	4·8	4·6	4·7	0·944	·300	4th	6	0	0	0	8	7	1	9	5	11	2	7	5	15	1	5
May - -	7·2	5·7	6·5	1·459	·430	27th	12	0	0	0	3	12	0	7	9	7	0	6	10	20	3	0
June - -	6·2	6·6	6·4	1·814	·327	14th	16	0	0	1	4	13	0	2	3	6	0	1	14	28	6	0
July - -	6·1	5·7	5·9	3·471	1·115	14th	15	0	0	1	7	11	0	9	6	9	1	2	5	19	11	0
August - -	5·8	5·1	5·4	2·003	·390	8th	13	0	0	2	7	10	0	4	4	6	3	2	11	30	2	0
September -	6·3	5·6	6·0	4·650	·850	2nd	16	0	0	3	7	11	0	1	5	14	4	4	9	20	3	0
October - -	7·3	5·8	6·5	5·300	·850	11th	20	0	2	1	2	13	0	2	4	5	20	8	2	19	2	0
November -	7·6	7·0	7·3	4·248	1·080	13th	16	2	4	0	1	14	0	6	5	21	1	6	5	12	4	0
December -	7·5	*6·1	*6·8	1·406	·610	21st	7	2	0	0	4	17	0	*0	5	10	0	0	4	37	2	0
Year -	6·8	6·1	6·5	31·350	—	—	167	12	7	8	52	156	1	49	56	124	41	66	99	238	48	5

* Four p.m. observations lost, 8th, 15th, 16th and 22nd.

MARLBOROUGH, WILTS.

Long. 1° 43′ W. Lat. 51° 25′ N. Height above Mean Sea Level, 471 feet.

Months.	Mean Pressure.	Air Temperature.									Tension of Vapour.			Relative Humidity.		
		9 a.m.	9 p.m.	Mean.	Means of		Absolute Min. and Max.				9 a.m.	9 p.m.	Mean.	9 a.m.	9 p.m.	Mean.
					Min.	Max.	Min.	Day.	Max.	Day.						
	ins.	°	°	°	°	°	°		°		in.	in.	in.	%	%	%
January - -	29·934	42·6	43·3	43·0	39·5	47·6	28·5	22nd	52·7	18th	·255	·262	·259	92	92	92
February - -	30·067	33·0	34·7	33·8	30·8	40·0	23·6	9th	52·4	14th	·171	·188	·179	88	91	89
March - -	·182	39·2	39·6	39·4	34·4	46·9	27·7	16th	55·2	31st	·205	·212	·209	83	85	84
April - -	·075	47·4	44·5	46·0	37·1	55·7	28·5	14th	71·0	20th	·249	·254	·251	75	86	81
May - -	30·038	55·3	51·0	53·1	44·5	63·4	38·0	3rd	79·2	15th	·331	·319	·325	75	85	80
June - -	29·935	59·6	54·7	57·2	48·8	67·0	40·5	22nd	79·9	3rd	·393	·373	·383	77	86	82
July - -	29·998	59·4	56·0	57·7	50·3	66·6	39·6	13th	76·7	29th	·409	·406	·408	81	90	85
August - -	30·064	62·7	58·0	60·3	52·6	70·8	41·2	1st	81·9	16th	·446	·432	·439	78	90	84
September -	30·060	59·8	56·3	58·1	50·8	68·2	41·2	11th	78·0	18th	·447	·415	·431	87	91	89
October - -	29·800	48·0	46·0	47·0	42·3	54·0	31·9	12th	67·6	5th	·303	·295	·299	90	95	93
November -	29·842	40 4	41·2	40·8	37·0	47·0	25·8	26th	59·4	4th	·234	·247	·240	93	95	94
December -	30·148	37·1	37·7	37·4	33·7	42·2	19·0	6th	52·9	22nd	·205	·213	·209	93	94	93
Year -	30·012	48·7	46·9	47·8	41·8	55·8	—	—	—	—	·304	·301	·303	84·3	90·0	87·2

MARLBOROUGH, WILTS—*Continued.*

Thermometers 4 feet above ground. Rain-gauge 1 foot above ground.

Months.	Amount of Cloud.			Rainfall.			Weather, No. of Days of							Wind, No. of Observations of								
	9 a.m.	9 p.m.	Mean.	Total.	Max.	Day.	Rain.	Snow.	Hail.	Thunder Storms.	Clear Sky.	Overcast.	Gales.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
				ins.	ins.																	
January - -	8·4	8·6	8·5	4·532	·562	1st	23	2	1	1	2	23	1	0	0	2	2	7	6	9	0	15
February - -	6·9	6·6	6·8	2·125	·619	6th	13	8	1	0	4	15	0	2	3	19	2	1	2	1	0	24
March - -	6·9	7·2	7·0	1·334	·575	6th	8	2	3	0	3	16	0	4	6	14	2	2	4	6	2	22
April - -	6·0	4·7	5·4	1·642	·340	6th	11	0	3	0	9	9	0	2	7	13	1	2	6	6	1	22
May - -	6·9	3·6	5·2	2·513	·579	28th	13	0	0	1	6	10	0	3	5	1	3	3	10	11	4	22
June - -	7·6	5·1	6·4	2·781	·542	13th	18	0	1	2	2	8	0	1	4	1	0	2	15	12	1	24
July - -	8·3	5·8	7·0	5·599	2·322	14th	13	0	0	0	2	14	0	1	9	6	2	2	3	11	3	25
August - -	6·7	5·9	6·3	2·118	·965	12th	13	0	0	3	4	10	0	1	1	3	2	5	5	10	4	31
September -	6·8	5·3	6·1	3·781	·825	21st	17	0	0	1	4	11	0	1	3	10	2	3	5	8	1	27
October - -	8·2	6·9	7·5	7·644	1·315	9th	17	0	0	1	3	19	0	2	2	11	10	4	5	10	1	17
November -	8·2	7·9	8·1	4·329	·791	13th	18	7	0	0	1	20	0	6	4	12	3	2	3	18	2	10
December -	8·4	7·1	7·7	1·313	·350	2nd	16	4	0	0	2	18	0	4	3	3	1	7	5	12	1	26
Year -	7·4	6·2	6·8	39·711	—	—	180	23	9	9	42	173	1	27	47	95	30	40	69	114	20	265

Wind :—January, 21 p.m. observations lost. February, 2 p.m. observations lost.

STRATHFIELD TURGISS.

Long. 1° 0′ W. Lat. 51° 20′ N. Height above Mean Sea Level, 196 feet.

Months.	Mean Pressure.	Air Temperature.									Tension of Vapour.			Relative Humidity.		
		9 a.m.	9 p.m.	Mean.	Means of.		Absolute Min. and Max.				9 a.m.	9 p.m.	Mean.	9 a.m.	9 p.m.	Mean.
					Min.	Max.	Min.	Day.	Max.	Day.						
	ins.	°	°	°	°	°	°		°		in.	in.	in.	%	%	%
January - -	29·947	43·3	42·2	42·8	37·8	48·3	**10·3**	**1st**	53·3	19th	·266	·257	·262	93·5	94·0	93·8
February - -	30·056	34·5	34·8	34·6	30·4	40·5	23·0	6th	50·8	14th	·180	·188	·184	88·4	91·1	89·8
March - -	·174	40·7	40·3	40·5	†34·5	47·8	27·3	10th	57·1	31st	·216	·219	·217	83·8	86·2	85·0
April - -	*·064	48·0	44·4	46·2	36·1	57·5	26·3	14th	73·0	20th	·262	·264	·263	78·4	90·0	84·2
May -	30·038	57·3	52·2	54·8	43·8	65·5	34·7	17th	80·1	15th	·361	·349	·355	76·9	89·1	83·0
June - -	29·937	60·2	55·8	58·0	48·2	68·6	40·0	22nd	82·4	3rd	·410	·397	·404	79·0	88·9	84·0
July - -	*29·979	60·8	56·3	58·5	49·9	68·4	40·2	13th	77·8	29th	·429	·412	·420	81·2	90·3	85·8
August - -	*30·068	63·1	58·8	61·0	52·0	72·7	40·4	1st	**83·9**	**16th**	·464	·450	·457	80·5	90·2	85·4
September -	30·057	60·6	56·3	58·4	49·8	70·1	40·0	11th	81·4	18th	·444	·418	·431	83·9	91·5	87·7
October - -	29·803	49·5	46·7	48·1	41·3	55·2	29·4	12th	69·5	5th	·321	·307	·314	89·0	94·2	91·6
November -	29·830	41·8	41·9	41·9	36·2	48·3	23·3	25th	59·1	4th	·244	·254	·249	89·4	90·4	89·9
December -	30·138	*37·9	37·6	*37·8	33·2	42·9	19·0	5th	53·9	21st	*·209	·213	*·211	*89·7	90·8	*90·3
Year -	30·007	49·8	47·3	48·6	41·1	57·2	—	—	—	—	·317	·311	·314	84·5	90·6	87·5

* One observation lost. † Two observations lost.

STRATHFIELD TURGISS—*Continued.*

Thermometers 4 feet above ground. Rain-gauge 1 foot above ground.

Months.	Amount of Cloud.			Rainfall.			Weather, No. of Days of							Wind, No. of Observations of								
	9 a.m.	9 p.m.	Mean.	Total.	Max.	Day.	Rain.	Snow.	Hail.	Thunder Storms.	Clear Sky.	Overcast.	Gales.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
				ins.	ins.																	
January - -	7·5	8·2	7·9	3·648	·530	21st	22	2	0	1	2	18	0	0	1	5	4	10	15	15	5	7
February -	7·6	7·3	7·4	2·606	·804	24th	15	5	0	0	3	16	0	13	12	5	8	4	6	2	1	5
March - -	7·3	7·9	7·6	0·743	·327	5th	7	2	0	0	2	19	0	11	18	8	4	2	2	6	9	2
April - -	5·4	5·0	5·2	1·502	·547	8th	11	1	1	0	9	10	0	4	17	5	12	1	6	4	7	4
May - -	5·9	5·0	5·5	1·512	·337	6th	10	0	0	2	6	9	0	4	5	5	5	3	14	10	11	5
June - -	7·4	5·5	6·4	3·094	·878	18th	13	0	0	4	2	11	0	3	1	4	0	3	22	16	6	5
July - -	7·7	6·2	7·0	5·704	1·760	21st	15	0	0	0	3	15	0	7	12	3	3	5	9	9	9	5
August - -	8·2	6·4	7·3	1·349	·415	19th	11	0	0	5	1	16	0	9	5	1	1	2	17	9	7	11
September -	6·8	4·1	5·4	1·957	·524	21st	12	0	0	1	5	8	0	2	6	12	7	6	4	9	8	6
October - -	7·3	5·8	6·6	6·039	1·820	19th	15	0	0	0	5	13	0	3	5	10	13	3	6	7	9	6
November -	8·2	7·4	7·8	3·422	·507	10th	14	2	0	1	2	19	0	10	12	4	5	3	5	9	9	3
December -	7·7	8·5	8·1	1·052	·319	2nd	11	4	0	0	1	18	0	12	2	2	7	5	13	8	6	7
Year -	7·3	6·4	6·9	32·628	—	—	156	16	1	14	41	172	0	78	96	64	69	47	119	104	87	66

STRATHFIELD TURGISS.

Long. 1° 0′ W. Lat. 51° 20′ N. Height above Mean Sea Level, 196 feet.

Months.	Mean Pressure.	Air Temperature.									Tension of Vapour.			Relative Humidity.		
		9 a.m.	9 p.m.	Mean.	Means of.		Absolute Min. and Max.				9 a.m.	9 p.m.	Mean.	9 a.m.	9 p.m.	Mean.
					Min.	Max.	Min.	Day.	Max.	Day.						
	ins.	°	°	°	°	°	°		°		in.	in.	in.	%	%	%
January - -	29·947	43·3	42·2	42·8	37·8	48·3	**10·3**	**1st**	53·3	19th	·266	·257	·262	93·5	94·0	93·8
February - -	30·056	34·5	34·8	34·6	30·4	40·5	23·0	6th	50·8	14th	·180	·188	·184	88·4	91·1	89·8
March - -	·174	40·7	40·3	40·5	†34·5	47·8	27·3	10th	57·1	31st	·216	·219	·217	83·8	86·2	85·0
April - -	*·064	48·0	44·4	46·2	36·1	57·5	26·3	14th	73·0	20th	·262	·264	·263	78·4	90·0	84·2
May -	30·038	57·3	52·2	54·8	43·8	65·5	34·7	17th	80·1	15th	·361	·349	·355	76·9	89·1	83·0
June - -	29·937	60·2	55·8	58·0	48·2	68·6	40·0	22nd	82·4	3rd	·410	·397	·404	79·0	88·9	84·0
July - -	*29·979	60·8	56·3	58·5	49·9	68·4	40·2	13th	77·8	29th	·429	·412	·420	81·2	90·3	85·8
August - -	*30·068	63·1	58·8	61·0	52·0	72·7	40·4	1st	**83·9**	**16th**	·464	·450	·457	80·5	90·2	85·4
September -	30·057	60·6	56·3	58·4	49·8	70·1	40·0	11th	81·4	18th	·444	·418	·431	83·9	91·5	87·7
October - -	29·803	49·5	46·7	48·1	41·3	55·2	29·4	12th	69·5	5th	·321	·307	·314	89·0	94·2	91·6
November -	29·830	41·8	41·9	41·9	36·2	48·3	23·3	25th	59·1	4th	·244	·254	·249	89·4	90·4	89·9
December -	30·138	*37·9	37·6	*37·8	33·2	42·9	19·0	5th	53·9	21st	*·209	·213	*·211	*89·7	90·8	*90·3
Year -	30·007	49·8	47·3	48·6	41·1	57·2	—	—	—	—	·317	·311	·314	84·5	90·6	87·5

* One observation lost. † Two observations lost.

STRATHFIELD TURGISS.

Height above Mean Sea Level 196 feet. Long. 1° 3′ W. Lat. 51° 20′ N.

JANUARY, 1875.

Day.	Barometer.		Air Temperature.				Vapour.		Humidity.		Wind and Force.			Cloud.		Rain fall.	Remarks.
	9 a.m.	9 p.m.	9 a.m.	9 p.m.	Min.	Max.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.		9 p.m.	9 a.m.	9 p.m.	9 a.m.	
	ins.	ins.	°	°	10s	°	ins.	ins.	%	%				10	9	ins.	
1	30·162	29·887	31·4	31·4	28·3	38·3	·168	·156	95	89	E	1	SE	10	9	·520	* sp. ← falling. 6p fine V
2	29·944	·980	36·4	43·3	30·6	49·6	·205	·273	95	98	SW	0–1	SW	4	2	·134	
3	·954	·977	48·5	42·8	35·2	49·8	·302	·266	87	97	W	1	W	2	10	·064	
4	29·910	29·787	48·5	48·5	34·7	50·3	·321	·333	95	98	SW	1–2	SW	10	10	·954	
5	30·007	30·031	40·1	43·5	38·3	48·5	·243	·249	98	88	W	1	W	10	10	—	
6	·023	·032	46·4	42·0	39·0	46·5	·286	·231	91	87	SW	1	S	9	10	—	
7	·068	·160	41·2	39·2	38·3	42·8	·231	·227	90	95	SE	1–0	NE	10	10	—	
8	·166	30·112	39·4	42·9	38·3	44·3	·235	·269	98	98	SE	0–1	S	10	10	—	
9	30·003	29·871	41·3	35·4	35·4	46·0	·244	·203	95	98	Calm	0	Calm	10	10	—	
10	29·798	·781	39·0	42·3	35·4	46·8	·235	·259	99	96	Calm	0	Calm	10	10	—	
11	·831	29·875	45·9	44·3	38·1	48·7	·301	·281	98	97	S	1	S	10	10	·113	
12	29·922	30·028	45·5	43·5	41·9	49·2	·298	·249	98	88	Calm	0	SW	10	10	·034	
13	30·089	·088	45·1	47·4	44·0	48·3	·294	·301	97	92	SE	1	S	7	9	·134	
14	30·062	30·078	49·8	49·0	47·3	50·4	·351	·331	98	96	SW	1–2	W	10	10	—	
15	29·894	29·865	47·3	47·1	45·5	52·0	·302	·308	93	96	S	1	W	5	7	·165	
16	·653	·737	44·4	45·5	44·0	50·4	·280	·288	96	95	W	1	NW	5	10	·075	
17	·756	·762	47·5	45·4	45·0	48·3	·293	·304	90	100	W	1	Calm	10	10	·275	
18	·846	·901	51·4	48·1	45·2	52·3	·366	·298	97	89	W	1–2	SW	10	10	·038	
19	·959	·763	48·1	47·4	45·5	53·3	·287	·301	86	92	W	1–2	W	9	10	·033	⊤ / during the night.
20	·764	·557	46·7	42·8	40·0	49·0	·292	·266	92	97	W	1	SW	3	10	·200	
21	·557	·336	40·5	37·9	30·4	49·5	·225	·206	90	90	NW	1	SW	9	10	·530	*
22	·935	33·8	35·2	31·6	44·1	162	·179	83	87	NW	0–1	NW	0	0	·150		
23	·630	·557	45·1	42·8	35·2	53·0	·294	·266	97	97	SW	1	S	10	10	·317	/ / in early morning. V
24	·300	·146	44·0	40·5	40·1	48·6	·260	·232	90	93	W	2–3	SW	0	10	·283	/ / V
25	29·394	29·766	44·4	36·4	36·4	47·0	·266	·192	91	90	W	2–3	NW	9	4	·004	
26	30·155	30·359	39·1	41·4	36·4	42·3	·222	·247	93	95	Calm	0	S	8	10	·003	
27	·246	·190	46·4	43·1	40·0	50·0	·306	·254	97	91	S	1	SW	10	5	·025	
28	·241	·205	47·1	47·4	42·5	52·1	·304	·318	94	97	W	1	SW	4	8	·205	
29	·321	·222	48·7	49·4	46·9	51·0	·336	·353	98	100	S	0–1	SW	10	10	·292	
30	·568	·673	38·4	30·0	29·6	49·8	·193	·161	84	97	E	1	E	5	0	—	⌋
31	30·600	30·483	32·0	32·3	27·6	45·0	·167	·165	92	91	E	0–1	E	3	0	—	
Means	29·953	29·940	43·3	42·2	37·8	48·3	·266	·257	93·5	94·0		0·9		7·5	8·2	3·648	
													1·0				

HAWES.

Height above Mean Sea Level 800 feet. Long. 2° 11′ W. Lat. 54° 18′ N.

FEBRUARY, 1875.

Day.	Barometer.		Air Temperature.				Tension of Vapour.		Relative Humidity.		Wind, Direction and Force.		Cloud Amount.		Rain.	Remarks.
	9 a.m.	9 p.m.	9 a.m.	9 p.m.	Min.	Max.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	
	ins.	ins.	°	°	°	°	ins.	ins.	%	%					ins.	
1	30·206	30·180	44·6	42·6	41·1	45·8	·276	·255	94	93	SW 2	SW 2	10	6	·060	
2	30·174	30·095	42·0	35·3	35·0	44·4	·245	·189	92	93	SW 1	W 1	10	6	—	
3	29·941	29·969	34·7	29·4	29·0	38·5	·151	·120	74	74	Calm 0	Calm 0	5	0	—	
4	30·084	30·259	31·8	30·3	27·4	40·2	·146	·131	81	77	Calm 0	Calm 0	9	0	—	
5	·392	·375	24·5	25·8	21·5	40·0	·089	·115	69	83	Calm 0	Calm 0	8	0	—	┘10
6	·316	·191	32·3	33·8	22·8	35·3	·183	·194	100	100	Calm 0	Calm 0	10	10	·190	┘2 *gp.* ≋ 9*a* ≋0 A few flakes of ✳0 at night.
7	·195	·177	32·0	29·8	29·5	34·0	·172	·144	95	86	Calm 0	E 2	10	10	·050	✳0 small.
8	·245	·267	28·5	28·5	27·7	31·0	·142	·151	91	96	Calm 0	Calm 0	10	10	—	Small ✳0 *a.* ≋ all day.
9	·194	·178	25·8	29·5	24·7	35·4	·095	·139	69	85	SSE 1	Calm 0	9	10	—	*gp* ≋
10	·219	30·192	29·5	29·1	28·5	35·0	·101	·108	63	68	Calm 0	Calm 0	10	10	—	9*a* ≋
11	30·080	29·796	30·7	35·1	29·0	36·7	·131	·188	75	92	Calm 0	NNW 1	10	10	·270	*gp* ✳0
12	29·871	·980	34·0	36·1	32·0	41·0	·186	·200	95	95	Calm 0	Calm 0	10	10	·030	*gp* ≋
13	30·005	29·927	36·6	44·6	35·8	45·4	·217	·269	100	92	Calm 0	Calm 0	10	5	·200	9*a* and *p.* ≋
14	29·771	30·058	47·0	40·5	39·2	48·3	·305	·241	95	96	SW 2	Calm 0	10	9	·120	
15	30·253	·476	37·1	36·3	35·1	46·2	·209	·185	95	87	Calm 0	Calm 0	6	1	—	┘
16	·491	·437	39·0	40·0	30·1	44·0	·181	·207	77	84	Calm 0	NNW 1	10	2	·010	┘2 6.30*p.*–8.30*p.* large Ⓤ0
17	·436	·394	37·8	34·9	34·7	40·0	·179	·158	79	77	N 1	N 3	10	1	·020	Showers of ●0 and ✳0
18	·388	·350	34·7	33·3	32·6	39·3	·184	·167	91	88	Calm 0	Calm 0	10	10	·050	✳ showers.
19	·351	·299	30·1	30·2	29·0	33·2	·121	·162	72	97	Calm 0	E 1	7	10	·020	✳ showers.
20	·350	·284	32·8	32·1	29·9	32·8	·146	·156	78	86	E 1	E 3	10	10	—	✳ showers.
21	·368	·388	33·0	33·2	31·6	38·2	·147	·145	78	77	E 2	E 2	9	10	—	✳0 showers.
22	·339	30·218	32·0	30·2	30·1	33·3	·153	·134	85	80	E 1	E 1	10	10	—	
23	30·015	29·741	29·0	29·0	28·2	34·0	·110	·120	70	76	Calm 0	Calm 0	10	10	·010	A few flakes of small ✳0
24	29·523	·493	29·3	32·0	27·1	34·8	·099	·157	62	87	Calm 0	ENE 2	5	10	·080	Small ✳0
25	·578	·651	31·2	33·0	30·0	33·8	·146	·177	83	95	E 1	E 1	10	10	·170	✳ all day, soft.
26	·737	·762	33·2	31·6	31·0	34·8	·181	·143	96	79	E 2	E 2	10	10	·080	✳ and thaw during day.
27	·868	·881	30·8	31·0	30·0	32·2	·145	·160	84	93	E 2	E 2	10	10	·010	✳ small and dry, soft at night.
28	29·953	29·935	28·6	29·2	28·1	31·0	·117	·133	76	83	E 2	E 1	10	10	·020	✳ very small and dry.
Means	30·114	30·105	33·3	33·1	30·4	37·8	·163	·166	82·8	86·4	0·6	0·9	9·2	7·5	1·390	

STRATHFIELD TURGISS.

Height above Mean Sea Level 196 feet. Long. 1° 8′ W. Lat. 51° 20′ N.

FEBRUARY, 1875.

Day.	Barometer.		Air Temperature.				Tension of Vapour.		Relative Humidity.		Wind, Direction and Force.		Cloud Amount.		Rain.	Remarks.
	9 a.m.	9 p.m.	9 a.m.	9 p.m.	Min.	Max.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	
	ins.	ins.	°	°	°	°	ins.	ins.	%	%					ins.	
1	30·397	30·334	33·1	35·3	28·3	49·7	·184	·184	98	90	S 1	SE 1	0	0	—	
2	30·284	30·140	33·4	33·1	29·7	44·3	·180	·184	95	98	SW 1	SW 1	10	0	·030	≡ a.m. ○
3	29·975	29·950	39·0	32·4	32·0	44·3	·231	·176	98	97	W 1	Calm 0	10	1	—	
4	30·035	30·197	31·0	32·9	25·6	41·2	·156	·172	90	92	N 1	N 1	0	10	—	⌋
5	·359	·406	32·8	28·0	26·3	34·0	·170	·153	91	100	Calm 0	SE 0–1	10	10	—	≡ p.m.
6	·358	·202	30·7	39·6	23·0	39·6	·136	·235	78	97	SE 0–1	S 0–1	10	10	·637	≡
7	·101	·165	39·4	32·3	32·0	41·0	·215	·165	90	91	NE 0–1	N 0–1	10	10	·010	≡
8	·242	·357	32·3	30·7	28·6	34·0	·165	·136	91	78	SE 0–1	NE 1	8	10	—	≡ *
9	·164	·106	28·0	32·0	24·0	33·2	·131	·157	86	87	E 1	N 0–1	9	10	—	
10	·185	·223	32·8	31·4	31·0	33·0	·170	·167	91	95	E 1	Calm 0	10	10	—	
11	30·187	30·031	31·4	40·5	28·0	40·5	·156	·225	89	90	S 0–1	SW 1	8	10	·204	
12	29·888	29·960	42·6	44·0	38·3	47·0	·273	·288	100	100	SW 1	W 0–1	10	10	·021	≡ before 9p.
13	30·078	30·084	40·4	45·0	40·0	46·0	·251	·299	100	100	SE 0–1	S 0–1	10	10	·020	
14	·053	·068	47·9	49·3	44·6	50·8	·311	·344	94	98	SW 1	SW 1	10	10	·073	
15	·265	·442	36·4	36·0	31·3	50·4	·192	·192	90	91	Calm 0	N 1	0	0	—	
16	·525	·367	37·9	40·5	29·5	47·0	·206	·225	90	90	N 0–1	N 1	2	10	·040	
17	·317	·260	39·4	38·3	35·8	45·7	·215	·192	90	83	N 1	NW 1	10	8	·056	
18	·264	·224	36·1	32·0	29·0	40·9	·182	·172	86	95	N 1	N 0–1	9	0	·039	● *
19	·187	·168	31·5	31·4	29·1	33·5	·131	·167	73	95	NE 1	N 1	10	0	·034	
20	·040	·071	30·0	29·9	29·0	32·5	·161	·144	97	87	E 1	N 0–1	10	10	·172	**
21	·114	·180	32·4	32·3	29·9	37·8	·176	·176	97	97	NE 1	E 1	10	6	—	
22	30·171	30·084	32·4	31·0	28·3	40·0	·141	·197	77	72	NE 1–2	NE 1–2	0	10	—	
23	29·895	29·634	30·3	30·5	28·2	36·3	·113	·133	67	78	NE 2	NE 1	3	10	—	
24	·387	·349	28·0	32·3	25·2	33·1	·122	·165	80	91	NE 0–1	Calm 0	10	10	·804	* [a]
25	·456	·516	36·4	32·4	29·0	41·8	·153	·176	72	97	SE 0–1	N 1	3	0	·348	
26	·505	·469	36·3	38·9	32·3	45·0	·208	·201	97	86	SE 1	SE 2	10	10	·148	○
27	·624	·707	32·7	31·4	30·5	38·9	·167	·144	90	81	E 1	NE 1	10	10	—	△
28	29·783	29·794	30·7	30·4	30·0	32·2	·136	·158	78	94	NE 1	NE 1	10	10	—	△
Means	30·066	30·047	34·5	34·8	30·3	40·5	·180	·188	88·4	91·1	0·8	0·8	7·6	7·3	2·666	

HAWES.

Height above Mean Sea Level 800 feet. Long. 2° 11′ W. Lat. 54° 18′ N.

MARCH, 1875.

Day.	Barometer.		Air Temperature.				Tension of Vapour.		Relative Humidity.		Wind, Direction and Force.		Cloud Amount.		Rain.	Remarks.
	9 a.m.	9 p.m.	9 a.m.	9 p.m.	Min.	Max.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	
	ins.	ins.	°	°	°	°	ins.	ins.	%	%					ins.	
1	29·932	29·992	31·0	30·1	28·6	33·0	·146	·115	84	68	ENE 1	ENE 1	10	10	—	✳° very small and dry.
2	30·024	30·049	32·5	31·0	29·6	33·5	·133	·174	73	100	NE 1	E 1	10	10	·020	✳° in evening, small and dry.
3	·044	·122	32·0	30·0	30·0	33·0	·157	·140	87	83	E 2	E 2	10	10	·010	✳ soft with ✢ Thaw in afternoon.
4	·115	30·103	30·2	28·2	28·0	35·0	·130	·122	77	79	E 2	E 2	9	4	—	
5	30·064	29·941	31·0	30·6	27·6	35·0	·148	·166	85	97	Calm 0	E 2	10	10	·030	
6	29·743	·559	32·1	38·9	30·2	38·9	·162	·218	90	93	ESE 1	SE 1	10	9	·370	8 a. ✳ large and soft. 9p. ● and ▨
7	·566	·726	46·0	47·0	38·6	48·7	·287	·286	93	90	SW 2	SW 3	9	9	·210	
8	·883	29·823	43·0	49·0	42·6	49·2	·268	·324	97	94	SW 1	SSW 1	10	10	·540	▨° in morning.
9	29·451	30·364	38·8	36·5	36·5	49·0	·212	·179	90	83	WSW 4	SW 2	9	1	·030	
10	30·478	·485	37·0	34·9	26·0	48·0	·152	·183	69	90	Calm 0	E 1	9	9	—	12
11	·404	·349	33·5	33·0	31·0	42·2	·156	·149	82	79	ESE 1	E 2	9	7	·020	✳° small and soft all day.
12	·189	·126	31·9	31·7	31·2	34·0	·161	·172	89	96	E 2	E 2	10	10	·030	✳° small and soft all day.
13	·125	·169	33·0	32·4	31·6	33·8	·153	·162	81	90	E 2	E 2	10	10	·010	
14	·247	·282	34·0	32·3	32·0	35·6	·176	·153	89	84	E 1	E 1	10	10	—	
15	·267	·265	35·2	35·0	31·5	48·3	·169	·184	82	90	E 1	Calm 0	10	10	—	9 p. ▨
16	·244	·264	33·0	34·5	27·2	42·3	·183	·154	98	77	Calm 0	Calm 0	10	10	—	○ ▨ all day.
17	·458	·682	35·0	33·5	32·1	37·0	·156	·133	76	72	NE 1	NE 1	9	10	—	✳° ○
18	·665	·286	32·4	35·5	28·0	39·7	·133	·188	73	91	Calm 0	SW 2	8	10	·020	✳° a few flakes, turning at 5.30p. into ✳ showers.
19	·190	·187	38·5	39·0	29·0	46·0	·195	·135	84	79	NW 1	SSW 1	10	0	—	
20	·216	·239	34·0	39·1	26·4	38·0	·131	·108	67	68	Calm 0	Calm 0	9	8	—	○ ▨° in evening.
21	·209	·178	35·0	36·6	24·0	45·0	·162	·200	78	93	Calm 0	Calm 0	10	10	—	✳° before 9a.
22	·134	·249	43·1	41·0	36·5	47·5	·333	·213	83	83	Calm 0	Calm 0	10	5	—	
23	·370	·380	38·2	40·0	32·4	44·5	·195	·207	85	84	Calm 0	Calm 0	10	10	—	▨° in evening.
24	·344	·330	41·7	43·7	34·0	48·8	·338	·245	91	85	Calm 0	W 1	10	10	—	⊏
25	·228	·111	44·0	43·9	42·9	46·1	·239	·264	83	92	WSW 1	SW 3	10	10	·190	
26	30·067	·044	44·9	40·0	39·7	47·2	·255	·214	86	87	SW 3	WSW 2	10	1	·130	
27	29·942	·009	38·0	35·8	35·0	44·5	·303	·158	89	75	W 2	NW 2	10	3	·030	Rough showers of ● and ▲ Sleet.
28	30·256	·378	36·0	42·0	33·0	44·7	·156	·223	74	84	NNW 1	NW 1	10	9	—	
29	·445	·453	41·6	43·0	37·2	49·2	·199	·234	76	84	Calm 0	W 1	10	9	·020	✳° a few flakes in morning.
30	·513	·564	45·2	45·1	41·4	49·0	·350	·242	83	81	Calm 0	Calm 0	10	10	—	
31	30·551	30·622	48·0	43·7	42·0	51·0	·339	·239	72	80	Calm 0	Calm 0	9	10	—	
Means	30·173	30·204	37·1	36·6	32·8	43·5	·186	·189	82·8	84·9	1·0	1·2	9·7	8·2	1·660	

STRATHFIELD TURGISS.

Height above Mean Sea Level 169 feet. Long. 1° 0′ W. Lat. 51° 20′ N.

MARCH, 1875.

Day.	Barometer.		Air Temperature.				Vapour.		Humidity.		Wind and Force.		Amount.		Rain.	Remarks.
	9 a.m.	9 p.m.	9 a.m.	9 p.m.	Min.	Max.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	
	ins.	ins.	°	°	°	°	ins.	ins.	%	%					ins.	
1	29.789	29.798	31.0	38.2	29.0	32.8	.153	.154	88	85	NE 1	NE 1	10	10	.026	* ge and gp
2	.816	.870	31.5	33.0	30.0	33.0	.165	.163	94	87	NE 1	NE 1	10	10	.040	ge * Δ
3	.867	29.935	33.5	34.1	31.4	35.1	.161	.156	84	78	NE 1	SE 1	10	10	—	ge
4	.998	30.006	33.9	35.6	29.2	40.0	.172	.185	88	89	E 1	SE 1	10	10	—	ge
5	.992	29.861	35.3	37.9	32.0	47.2	.184	.177	90	78	E 0-1	SE 1-2	8	3	.337	
6	.734	.668	42.3	47.4	37.3	49.8	.266	.301	90	92	E 1	S 1	10	10	.137	
7	29.863	29.920	51.5	49.0	47.0	54.7	.342	.331	90	96	SW 1	S 1-2	9	10	.173	ge *
8	30.045	30.067	52.4	50.1	49.0	55.3	.371	.346	94	96	W 1-2	SW 1	10	10	—	
9	29.911	.338	52.5	40.1	37.6	54.0	.289	.209	74	85	W 2-3	NW 1	8	0	—	
10	30.444	.404	37.5	36.4	27.8	52.2	.160	.192	72	90	NW 0-1	NE 1	0	0	—	
11	.289	30.135	39.4	38.9	—	46.8	.191	.281	80	77	E 1-2	E 1	0	10	—	
12	30.004	29.937	34.9	36.4	34.5	38.9	.203	.193	100	90	E 1	NE 1	10	10	—	
13	29.946	29.991	38.3	39.6	36.1	41.0	.193	.211	83	87	NE 1-2	NE 0-1	9	10	—	ge
14	30.084	30.142	39.8	33.4	33.4	48.7	.218	.180	90	95	NE 1	NE 1	10	0	—	
15	.190	.227	35.3	35.4	31.7	46.2	.184	.199	90	96	N 1	NE 1	10	0	—	ge before ge.
16	.266	.191	31.5	43.6	30.0	49.3	.177	.248	100	87	Calm 0	N 1	10	10	.005	ge
17	.295	.512	36.4	36.5	36.0	44.0	.192	.169	90	79	N 1	NE 1-2	10	9	—	
18	.601	.457	34.0	32.0	29.7	43.0	.148	.162	76	90	E 2	E 0-1	0	8	.035	
19	.200	.119	41.9	35.9	30.6	51.3	.244	.207	92	98	NW 1	E 1	10	10	—	
20	.174	.175	39.3	35.7	29.4	43.5	.166	.165	69	79	N 1	NE 1	2	9	—	
21	.196	.204	39.4	37.0	33.4	43.9	.171	.187	71	85	N 1	NE 1	9	9	—	
22	.125	.164	41.1	44.1	33.0	50.6	.228	.244	89	84	NW 1	NE 2	10	10	—	
23	.347	.392	39.9	36.5	33.5	48.4	.189	.186	77	87	NE 1	NE 0-1	0	0	—	
24	.308	.414	41.0	46.8	33.6	53.1	.208	.238	81	75	NW 1	NW 1	10	10	—	
25	.414	.328	46.8	45.8	36.3	55.8	.238	.266	75	87	W 1	W 1	3	10	—	
26	.280	.191	51.0	46.4	43.3	56.4	.275	.289	74	92	W 1-2	W 1	8	10	—	
27	.148	.096	48.5	44.3	35.8	55.5	.227	.225	67	77	NW 1-2	NW 2	2	6	—	
28	.248	.370	41.4	43.2	35.2	48.3	.179	.223	69	80	N 2	N 1	9	10	—	
29	.490	.495	46.5	45.4	33.0	51.6	.246	.230	79	76	N 2	NW 1	0	10	—	
30	.511	.553	48.0	47.4	41.4	55.7	.281	.301	85	92	N 1	Calm 0	10	10	—	
31	30.564	30.573	46.9	48.5	—	57.1	.276	.280	87	83	N 1	N 0-1	10	10	—	
Means	30.169	30.178	40.7	40.3	*34.5	47.8	.216	.219	83.8	86.2	1.2	1.0	7.3	7.9	0.743	

* Mean for 29 days only.

HAWES.

Height above Mean Sea Level 800 feet. Long. 2° 11′ W. Lat. 54° 18′ N.

FEBRUARY, 1875.

Day.	Barometer.		Air Temperature.				Tension of Vapour.		Relative Humidity.		Wind, Direction and Force.		Cloud Amount.		Rain.	Remarks.
	9 a.m.	9 p.m.	9 a.m.	9 p.m.	Min.	Max.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	
	ins.	ins.	°	°	°	°	ins.	ins.	%	%					ins.	
1	30·206	30·180	44·6	42·6	41·1	45·8	·276	·255	94	93	SW 2	SW 2	10	6	·060	
2	30·174	30·095	42·0	35·3	35·0	44·4	·245	·189	92	93	SW 1	W 1	10	6	—	
3	29·941	29·969	34·7	29·4	29·0	38·5	·151	·120	74	74	Calm 0	Calm 0	5	0	—	
4	30·084	30·259	31·8	30·3	27·4	40·2	·146	·131	87	77	Calm 0	Calm 0	9	0	—	
5	·392	·375	24·5	25·8	21·5	40·0	·089	·115	69	83	Calm 0	Calm 0	8	0	—	⌋°
6	·316	·191	32·3	33·8	22·8	35·3	·183	·104	100	100	Calm 0	Calm 0	10	10	·190	⌋² *gp.* ≋
7	·195	·177	32·0	29·8	29·5	34·0	·172	·144	95	86	Calm 0	E 2	10	10	·050	*gs* ≋° A few flakes of ✳° at night.
8	·245	·267	28·5	28·5	27·7	31·0	·142	·151	91	96	Calm 0	Calm 0	10	10	—	✳° small.
9	·194	·178	25·8	29·5	24·7	35·4	·095	·139	69	85	SSE 1	Calm 0	9	10	—	Small ✳° *a.* ≋ all day.
10	·219	30·192	29·5	29·1	28·5	35·0	·101	·108	63	68	Calm 0	Calm 0	10	10	—	*gp* ≋
11	30·080	29·796	30·7	35·1	29·0	36·7	·131	·188	75	92	Calm 0	NNW 1	10	10	·270	*gs* ≋
12	29·871	·980	34·0	36·1	32·0	41·0	·186	·200	95	95	Calm 0	Calm 0	10	10	·030	*gp* ✳°
13	30·005	29·927	36·6	44·6	35·8	45·4	·217	·269	100	92	Calm 0	Calm 0	10	5	·200	*gp* ≋
14	29·771	30·058	47·0	40·5	39·2	48·3	·305	·241	95	96	SW 2	Calm 0	10	9	·120	*gs* and *p.* ≋
15	30·253	·476	37·1	36·3	35·1	46·2	·209	·185	95	87	Calm 0	Calm 0	6	1	—	⌋
16	·491	·437	39·0	40·0	30·1	44·0	·181	·207	77	84	Calm 0	NNW 1	10	3	·010	⌋² 6.30*p*–8.30*p.* large ☿°
17	·436	·394	37·8	34·9	34·7	40·0	·179	·158	79	77	N 1	N 2	10	1	·020	Showers of ● ° and ✳°
18	·388	·350	34·7	33·3	32·6	39·3	·184	·167	91	88	Calm 0	Calm 0	10	10	·050	✳ showers.
19	·351	·399	30·1	30·2	29·0	33·2	·121	·162	72	97	Calm 0	E 1	7	10	·020	✳ showers.
20	·350	·284	32·8	32·1	29·9	32·8	·146	·156	78	86	E 1	E 3	10	10	—	✳° showers.
21	·368	·388	33·0	33·2	31·6	38·2	·147	·145	78	77	E 2	E 2	9	10	—	
22	·339	30·218	32·0	30·2	30·1	33·3	·153	·134	85	80	E 1	E 1	10	10	—	A few flakes of small ✳°
23	30·015	29·741	29·0	29·0	28·2	34·0	·110	·130	70	76	Calm 0	Calm 0	10	10	·010	Small ✳°
24	29·543	·493	30·3	32·0	27·1	34·8	·099	·157	62	87	Calm 0	ENE 2	5	10	·080	Small ✳°
25	·578	·651	31·2	33·0	30·0	33·8	·146	·177	83	95	E 1	E 1	10	10	·170	✳ all day, soft.
26	·737	·762	33·2	31·6	31·0	34·8	·181	·143	96	79	E 2	E 2	10	10	·080	✳ and thaw during day.
27	·868	·881	30·8	31·0	30·0	32·2	·145	·160	84	93	E 2	E 2	10	10	·010	✳ small and dry, soft at night.
28	29·953	29·935	28·6	29·2	28·1	31·0	·117	·133	76	83	E 2	E 1	10	10	·020	✳ very small and dry.
Means	30·114	30·105	33·3	33·1	30·4	37·8	·163	·166	82·8	86·4	0·6	0·9	9·2	7·5	1·390	

STRATHFIELD TURGISS.

Height above Mean Sea Level 196 feet. Long. 1° 8′ W. Lat. 51° 20′ N.

FEBRUARY, 1875.

Day.	Barometer.		Air Temperature.				Tension of Vapour.		Relative Humidity.		Wind, Direction and Force.		Cloud Amount.		Rain.	Remarks.
	9 a.m.	9 p.m.	9 a.m.	9 p.m.	Min.	Max.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	
	ins.	ins.	°	°	°	°	ins.	ins.	%	%					ins.	
1	30·397	30·354	33·1	35·3	28·3	49·7	·184	·184	98	90	S 1	SE 1	0	0	—	
2	30·284	30·140	33·4	33·1	29·7	44·2	·180	·184	95	98	SW 1	SW 1	10	0	·030	a.m.
3	29·975	29·950	39·0	32·4	32·0	44·2	·231	·176	98	97	W 1	Calm 0	10	1	—	
4	30·035	30·197	31·0	32·9	25·6	41·2	·156	·172	90	93	N 1	N 1	0	10	—	
5	·359	·406	32·8	28·0	26·3	34·0	·170	·153	91	100	Calm 0	SE 0-1	10	10	—	p.m.
6	·358	·202	30·7	30·6	23·0	30·6	·136	·235	78	97	SE 0-1	S 0-1	10	10	·627	
7	·101	·165	30·4	32·3	32·0	41·0	·215	·165	90	91	NE 0-1	N 0-1	10	10	·010	
8	·242	·257	32·3	30·7	28·6	34·0	·165	·136	91	78	SE 0-1	NE 1	8	10	—	
9	·164	·106	28·0	32·0	24·0	33·2	·131	·157	86	87	E 1	N 0-1	9	10	—	
10	·185	·223	32·8	31·4	31·0	33·0	·170	·167	91	95	E 1	Calm 0	10	10	—	
11	30·187	30·031	31·4	40·5	28·0	40·5	·156	·225	89	90	S 0-1	SW 1	8	10	·204	
12	29·888	29·960	42·6	44·0	38·3	47·0	·273	·288	100	100	SW 1	W 0-1	10	10	·021	before 9p.
13	30·078	30·084	40·4	45·0	40·0	46·0	·251	·299	100	100	SE 0-1	S 0-1	10	10	·030	
14	·052	·068	47·9	49·3	44·6	50·8	·311	·344	94	98	SW 1	SW 1	10	10	·073	
15	·265	·442	36·4	36·0	31·3	50·4	·192	·192	90	91	Calm 0	N 1	0	0	—	
16	·535	·367	37·9	40·5	29·5	47·0	·266	·235	90	90	N 0-1	N 1	2	10	·040	
17	·317	·260	39·4	38·3	35·8	45·7	·215	·192	90	83	N 1	NW 1	10	8	·056	
18	·264	·224	36·1	32·0	29·0	40·9	·182	·172	86	95	N 1	N 0-1	9	0	·039	
19	·187	·108	31·5	31·4	29·1	33·5	·131	·167	73	95	NE 1	N 1	10	0	·034	
20	·040	·071	30·0	29·9	29·0	32·5	·161	·144	97	87	E 1	N 0-1	10	10	·172	
21	·114	·180	32·4	32·3	29·9	37·8	·176	·176	97	97	NE 1	E 1	10	6	—	
22	30·171	30·084	32·4	31·0	28·3	40·0	·141	·127	77	72	NE 1-2	NE 1-2	0	10	—	
23	29·895	29·634	30·3	30·5	28·2	36·3	·113	·133	67	78	NE 2	NE 1	3	10	—	
24	·387	·349	28·0	32·3	25·2	33·1	·122	·165	80	91	NE 0-1	Calm 0	10	10	·804	a
25	·456	·516	36·4	32·4	29·0	41·8	·153	·176	72	97	SE 0-1	N 1	3	0	·348	
26	·595	·469	36·3	38·9	32·3	45·0	·208	·201	97	86	SE 1	SE 2	10	10	·148	
27	·624	·707	32·7	31·4	30·5	38·9	·167	·144	90	81	E 1	NE 1	10	10	—	
28	29·783	29·794	30·7	30·4	30·0	32·2	·136	·158	78	94	NE 1	NE 1	10	10	—	
Means	30·066	30·047	34·5	34·8	30·3	40·5	·180	·188	88·4	91·1	0·8	0·8	7·6	7·3	2·666	

HAWES.

Height above Mean Sea Level 800 feet. Long. 2° 11′ W. Lat. 54° 18′ N.

MARCH, 1875.

Day.	Barometer.		Air Temperature.				Tension of Vapour.		Relative Humidity.		Wind, Direction and Force.		Cloud Amount.		Rain.	Remarks.
	9 a.m.	9 p.m.	9 a.m.	9 p.m.	Min.	Max.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	
	ins.	ins.	°	°	°	°	ins.	ins.	%	%					ins.	
1	29·932	29·992	31·0	30·1	28·6	33·0	·146	·115	84	68	ENE 1	ENE 1	10	10	—	✳° very small and dry.
2	30·024	30·049	32·5	31·0	29·6	33·5	·133	·174	73	100	NE 1	E 1	10	10	·020	✳✳° in evening, small and dry.
3	·044	·122	32·0	30·0	30·0	33·0	·157	·140	87	83	E 2	E 2	10	10	·010	✳✳ soft with ✢ Thaw in afternoon.
4	·115	30·103	30·2	28·2	28·0	35·0	·130	·122	77	79	E 2	E 2	9	4	—	
5	30·064	29·941	31·0	30·6	27·6	35·0	·148	·166	85	97	Calm 0	E 2	10	10	·030	
6	29·743	·559	32·1	28·9	30·2	38·9	·162	·218	90	93	ESE 1	SE 1	10	9	·370	8 a. ✳ large and soft. 9p. ● and ▨
7	·566	·726	46·0	47·0	38·6	48·7	·287	·286	93	90	SW 2	SW 3	9	9	·210	
8	·883	29·823	43·0	49·0	42·6	49·2	·268	·324	97	94	SW 1	SSW 1	10	10	·540	▨° in morning.
9	29·451	30·364	38·8	36·5	36·5	49·0	·212	·179	90	83	WSW 4	SW 2	9	1	·030	
10	30·478	·465	37·0	34·9	26·0	48·0	·152	·183	69	90	Calm 0	E 1	9	9	—	12
11	·404	·349	33·5	33·0	31·0	42·2	·156	·149	82	79	ESE 1	E 2	9	7	·020	
12	·189	·126	31·9	31·7	31·2	34·0	·161	·172	89	96	E 2	E 2	10	10	·030	✳ small and soft all day.
13	·125	·169	33·0	32·4	31·6	33·8	·153	·162	81	90	E 2	E 2	10	10	·010	✳✳ small and soft all day.
14	·247	·262	34·0	32·3	32·0	35·6	·176	·153	89	84	E 1	E 1	10	10	—	
15	·267	·265	35·2	35·0	31·5	48·3	·169	·184	82	90	E 1	Calm 0	10	10	—	9 p. ▨
16	·244	·264	33·0	34·5	27·2	42·3	·183	·154	98	77	Calm 0	Calm 0	10	10	—	☾ ▨ all day.
17	·458	·682	35·0	33·5	32·1	37·0	·156	·133	76	72	NE 1	NE 1	9	10	—	☾
18	·665	·286	32·4	35·5	28·0	39·7	·133	·188	73	91	Calm 0	SW 2	8	10	·020	✳° a few flakes, turning at 5.30p. into [✳ showers.
19	·190	·187	38·5	39·0	29·0	46·0	·195	·125	84	79	NW 1	SSW 1	10	0	—	
20	·216	·229	34·0	29·1	26·4	38·0	·131	·108	67	68	Calm 0	Calm 0	9	8	—	☾ ▨° in evening.
21	·209	·198	35·0	36·6	24·0	45·0	·162	·200	78	93	Calm 0	Calm 0	10	10	—	✳° before 9a.
22	·134	·249	43·1	41·0	36·5	47·5	·233	·213	83	83	Calm 0	Calm 0	10	5	—	
23	·370	·380	38·2	40·0	32·4	44·5	·195	·207	85	84	Calm 0	Calm 0	10	10	—	▨° in evening.
24	·344	·330	41·7	43·7	34·0	48·8	·238	·245	91	85	Calm 0	W 1	10	10	—	☌
25	·228	·111	44·0	43·9	42·9	46·1	·239	·264	83	92	WSW 1	SW 3	10	10	·190	
26	30·067	·044	44·9	40·0	39·7	47·2	·255	·214	86	87	SW 3	WSW 2	10	1	·130	
27	29·942	·009	38·0	35·8	35·0	44·5	·203	·158	89	75	W 2	NW 2	10	3	·030	Rough showers of ● and ▲ Sleet.
28	30·256	·378	36·0	42·0	33·0	44·7	·156	·223	74	84	NNW 1	NW 1	10	9	—	✳° a few flakes in morning.
29	·445	·453	41·6	43·0	37·2	49·2	·199	·234	84	76	Calm 0	W 1	10	9	·020	
30	·513	·564	45·2	45·1	41·4	49·0	·250	·242	83	81	Calm 0	Calm 0	10	10	—	
31	30·551	30·622	48·0	43·7	42·0	51·0	·239	·239	72	80	Calm 0	Calm 0	9	10	—	
Means	30·173	30·204	37·1	36·6	32·8	42·5	·186	·189	82·8	84·9	1·0	1·2	9·7	8·2	1·660	

STRATHFIELD TURGISS.

Height above Mean Sea Level 169 feet. Long. 1° 0′ W. Lat. 51° 20′ N.

March, 1875.

Day.	Barometer.		Air Temperature.				Tension of Vapour.		Relative Humidity.		Wind, Direction and Force.			Cloud Amount.		Rain.	Remarks.
	9 a.m.	9 p.m.	9 a.m.	9 p.m.	Min.	Max.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.		9 p.m.	9 a.m.	9 p.m.	9 a.m.	
	ins.	ins.	°	°	°	°	ins.	ins.	%	%						ins.	
1	29·789	29·798	31·0	32·2	29·0	32·8	·153	·154	88	85	NE	1	NE 1	10	10	·026	✳ ga and gp Δ
2	·816	·870	31·5	33·0	30·0	33·0	·165	·163	94	87	NE	1	NE 1	10	10	·040	ga ✳
3	·867	29·935	33·5	34·1	31·4	35·1	·161	·156	84	78	NE	1	SE 1	10	10	—	
4	·908	30·006	33·9	35·6	29·2	40·0	·172	·185	88	89	E	1	SE 1	10	10	—	ga ≋≋
5	·992	29·861	35·3	37·9	32·0	47·2	·184	·177	90	78	E	0-1	SE 1-2	8	3	·327	
6	·734	·668	42·3	47·4	37·3	49·8	·266	·301	90	92	E	1	S 1	10	10	·137	
7	29·863	29·929	51·5	49·0	47·0	54·7	·342	·331	90	96	SW	1	S 1-2	9	10	·173	ga ✳
8	30·045	30·067	52·4	50·1	49·0	55·3	·371	·346	94	96	W	1-2	SW 1	10	10	—	
9	29·911	·338	52·5	40·1	37·6	54·0	·389	·269	74	85	W	2-3	NW 1	8	0	—	
10	30·444	·404	37·5	36·4	27·3	52·2	·160	·192	72	90	NW	0-1	NE 1	0	0	—	
11	·289	30·135	39·4	38·9	—	46·8	·191	·281	80	77	E	1-2	E 1	0	10	—	
12	30·004	29·937	34·9	36·4	34·5	38·9	·203	·192	100	90	E	1	NE 1	10	10	—	
13	29·946	29·991	38·3	39·6	36·1	41·0	·193	·211	83	87	NE	1-2	NE 0-1	9	10	—	≋≋
14	30·084	30·142	39·8	33·4	33·4	48·7	·218	·180	90	95	NE	1	NE 1	10	0	—	
15	·190	·227	35·3	35·4	31·7	46·2	·184	·199	90	96	N	1	NE 1	10	0	—	≋≋ before ga.
16	·266	·191	31·5	43·6	30·0	49·3	·177	·248	100	87	Calm	0	N 1	10	10	·005	≋≋
17	·295	·512	36·4	36·5	36·0	44·0	·192	·169	90	79	N	1	NE 1-2	10	9	—	
18	·601	·457	34·0	32·0	29·7	43·0	·148	·162	76	90	E	2	E 0-1	0	8	·035	
19	·200	·119	41·9	35·9	30·6	51·3	·244	·307	92	98	NW	1	E 1	10	10	—	
20	·174	·175	39·3	35·7	29·4	43·5	·166	·165	69	79	N	1	NE 1	2	9	—	
21	·196	·204	39·4	37·0	33·4	43·9	·171	·187	71	85	N	1	NE 1	9	9	—	
22	·125	·164	41·1	44·1	33·0	50·6	·228	·244	89	84	NW	1	NE 2	10	10	—	
23	·347	·392	39·9	36·5	33·5	48·4	·189	·186	77	87	NE	1	NE 0-1	0	0	—	
24	·308	·414	41·0	46·8	33·6	53·1	·208	·238	81	75	NW	1	NW 1	10	10	—	
25	·414	·328	46·8	45·8	36·3	55·8	·338	·266	75	87	W	1	W 1	3	10	—	
26	·280	·191	51·0	46·4	43·3	56·4	·275	·289	74	92	W	1-2	W 1	8	10	—	
27	·148	·096	48·5	44·3	35·8	55·5	·227	·225	67	77	NW	1-2	NW 2	2	6	—	
28	·248	·370	41·4	43·2	35·2	48·3	·179	·223	69	80	N	2	N 1	9	10	—	
29	·490	·495	46·5	45·4	33·0	51·6	·246	·330	79	76	N	3	NW 1	0	10	—	
30	·511	·553	48·0	47·4	41·4	55·7	·281	·301	85	92	N	1	Calm 0	10	10	—	
31	30·564	30·573	46·9	48·5	—	57·1	·276	·280	87	83	N	1	N 0-1	10	10	—	
Means	30·169	30·178	40·7	40·3	*34·5	47·8	·216	·219	83·8	86·2		1·2		7·3	7·9	0·743	

* Mean for 29 days only.

HAWES.

Height above Mean Sea Level 800 feet. Long. 2° 11′ W. Lat. 54° 18′ N.

April, 1875.

Day.	Barometer.		Air Temperature.				Tension of Vapour.		Relative Humidity.		Wind, Direction and Force.		Cloud Amount.		Rain.	Remarks.
	9 a.m.	9 p.m.	9 a.m.	9 p.m.	Min.	Max.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	
	ins.	ins.	°	°	°	°	ins.	ins.	%	%					ins.	
1	30·605	30·571	44·0	42·0	41·4	45·9	·190	·200	66	76	NW 1	Calm 0	5	10	—	
2	30·397	30·153	45·1	41·1	39·7	47·7	·242	·218	81	85	WSW 1	WSW 2	9	9	·100	
3	29·848	29·451	42·3	44·0	40·2	45·8	·246	·237	92	82	SW 3	WSW 4	10	4	·720	
4	·512	·512	41·1	35·8	35·1	46·0	·186	·179	73	86	W 4	Calm 0	7	10	·560	
5	·071	·188	43·3	36·9	32·8	46·0	·237	·183	84	84	SSW 1	SW 2	8	0	·410	● 2 and ✳ before 9a.
6	·324	·311	41·9	40·0	35·7	48·0	·207	·207	79	84	SW 1	SSE 1	10	2	·210	● 2 and △ 0 showers. ☈ 7p.
7	·354	29·580	40·0	39·3	35·0	50·0	·193	·203	78	85	Calm 0	Calm 0	10	8	·080	● and ✳ in past night.
8	29·795	30·014	39·0	38·3	38·3	41·0	·219	·224	93	97	NE 1	NE 2	10	10	·030	
9	30·146	·311	39·3	39·0	38·0	41·5	·222	·218	93	92	NNE 2	E 9	10	10	·030	
10	·388	·372	38·0	39·0	37·0	41·0	·215	·216	94	91	E 1	ENE 1	10	10	—	
11	·323	·328	42·2	37·9	35·8	44·2	·243	·220	90	97	NE 1	E 1	10	10	—	rp-gp.
12	·326	·358	40·2	37·0	35·0	49·0	·220	·182	89	83	Calm 0	E 1	10	0	—	≋ at noon.
13	·369	·384	39·4	34·0	33·5	51·0	·177	·168	74	85	Calm 0	Calm 0	7	0	—	] 3, ≋°, T (?) gp.
14	·321	·405	48·9	40·0	28·0	59·8	·226	·226	66	92	Calm 0	Calm 0	1	0	—	] 2, ≋, d
15	·439	·399	44·0	45·4	35·0	57·9	·252	·249	87	83	Calm 0	Calm 0	10	10	—	d 2, ≋°, d
16	·344	·297	48·6	45·4	38·0	61·8	·279	·254	82	84	Calm 0	Calm 0	0	0	—	d 2, ≋, d
17	·259	·191	48·0	45·9	34·6	62·5	·263	·257	79	84	Calm 0	Calm 0	0	0	—	d 2, ≋, d
18	·133	·118	49·4	48·0	35·1	68·9	·293	·270	84	81	Calm 0	Calm 0	8	0	—	] 2, ≋, d
19	·161	·204	53·5	47·7	35·3	67·7	·372	·348	67	76	Calm 0	Calm 0	0	0	—	d 2, ≋°, d
20	30·141	·036	60·1	47·0	34·2	69·8	·281	·218	55	68	Calm 0	Calm 0	0	0	—	d ≋°, d
21	29·932	30·065	51·5	36·8	36·5	58·8	·280	·174	75	80	Calm 0	E 1	7	10	—	d
22	29·986	29·939	41·9	35·0	31·0	52·9	·162	·165	62	79	Calm 0	Calm 0	6	7	—	
23	30·033	30·167	38·8	36·1	31·7	45·0	·190	·174	81	82	Calm 0	Calm 0	9	10	—	
24	·334	·270	41·5	38·0	35·0	53·0	·193	·179	75	77	Calm 0	Calm 0	10	0	—	
25	·267	·262	47·7	39·5	26·3	56·9	·208	·193	63	80	Calm 0	Calm 0	4	0	—	≋° in evening.
26	30·133	·047	49·8	48·0	28·0	56·8	·210	·243	59	73	Calm 0	SW 1	5	10	·020	] °
27	29·998	·045	47·2	47·0	44·4	55·0	·301	·292	93	91	WSW 1	W 2	10	7	—	
28	30·095	·126	52·9	46·7	43·5	58·8	·296	·276	74	87	Calm 0	W 2	9	5	—	d d d
29	·069	·110	51·5	48·2	46·0	57·9	·295	·305	78	91	W 1	W 1	9	8	—	
30	30·079	30·064	51·0	47·1	42·0	54·0	·299	·274	80	85	Calm 0	Calm 0	10	8	—	
Means	30·069	30·076	45·4	41·5	36·1	53·2	·236	·222	78·2	84·0	0·6	0·8	7·1	5·3	2·160	

STRATHFIELD TURGISS.

Height above Mean Sea Level 196 feet. Long. 1° 0′ W. Lat. 51° 20′ N.

April, 1875.

Day.	Barometer.		Air Temperature.				Tension of Vapour.		Relative Humidity.		Wind, Direction and Force.		Cloud Amount.		Rain.	Remarks.
	9 a.m.	9 p.m.	9 a.m.	9 p.m.	Min.	Max.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	
	ins.	ins.	°	°	°	°	ins.	ins.	%	%					ins.	
1	30·580	30·549	46·0	42·6	42·0	53·1	·264	·238	86	87	N 1	Calm 0	10	10	—	≋ 9a.
2	·507	30·375	45·3	44·0	38·3	54·9	·221	·334	74	81	N 1	W 1	10	10	—	
3	30·093	29·821	43·8	46·6	38·6	52·1	·261	·385	92	90	SW 1-2	SW 2-3	10	10	·037	
4	29·717	·584	49·4	47·7	44·2	56·8	·284	·313	81	95	NW 1	SW 1	4	10	·032	Slight gale.
5	·279	·362	47·1	42·9	42·0	56·4	·298	·350	92	91	SW 1-2	SW 2	3	5	·018	✳ · Stiff gale. ◀
6	·470	·397	49·8	40·5	34·6	55·9	·267	·326	75	90	SW 1-2	NW 1	5	8	·265	
7	·389	·481	44·0	42·4	42·3	55·4	·225	·353	77	94	NW 1	NW 1	4	9	·093	
8	·614	29·803	43·9	43·0	37·3	53·1	·225	·277	78	100	NE 1	NE 1-2	9	10	·547	
9	29·927	30·091	40·1	41·4	39·0	43·3	·233	·254	94	98	NE 2-3	N 1	10	10	·030	
10	30·158	·156	42·9	41·1	40·2	45·4	·256	·351	93	97	NE 1	NE 1	10	10	·038	
11	·155	·187	43·1	45·5	40·4	47·2	·266	·293	93	97	NE 1-2	NE 0-1	10	10	—	✳ ≋
12	·236	·167	42·0	38·5	38·1	47·7	·267	·315	100	93	NE 1	NE 1	10	0	—	≋ 9a.
13	·287	·321	41·4	40·3	34·0	50·1	·199	·333	77	94	NE 1-2	E 1	10	0	—	
14	·360	·345	37·9	40·5	20·3	56·0	·206	·325	90	90	SE 1	NE 1	5	0	—	≋ 9a.
15	·400	·401	43·8	40·3	34·4	53·8	·261	·333	92	94	SE 1	NE 1	0	0	—	
16	·401	·299	45·0	43·7	35·4	58·1	·233	·329	78	80	SE 1	SE 1	7	0	—	≋
17	·298	·155	51·8	47·0	30·9	63·6	·265	·294	70	92	SE 0-1	SSE 0-1	0	0	—	
18	·122	·087	51·5	47·4	30·3	66·2	·270	·304	72	90	SE 1	SE 0-1	0	0	—	
19	·144	·183	58·1	49·5	33·7	71·9	·317	·289	66	82	NE 0-1	SE 0-1	0	0	—	
20	30·185	30·047	58·9	49·2	34·2	73·0	·311	·309	63	86	SE 0-1	Calm 0	0	0	—	
21	29·909	29·908	56·4	46·2	36·0	70·5	·315	·313	69	100	SE 1	NE 1-2	10	10	·313	
22	·914	29·888	49·4	39·2	32·4	47·8	·233	·335	97	98	NE 1	NE 1	10	10	·086	
23	29·988	30·105	44·5	43·3	35·2	52·1	·203	·331	70	82	E 1	ENE 1	3	9	—	
24	30·239	·280	48·4	36·8	30·3	52·7	·208	·202	69	93	E 1	NE 1	2	0	—	
25	—	·279	49·4	41·3	26·6	60·2	·206	·209	58	81	N 1	Calm 0	0	0	—	
26	·220	·114	52·5	47·0	31·4	58·5	·259	·333	67	73	SE 1	E 0-1	10	9	—	○ 9a.
27	·069	·085	60·0	54·8	38·8	67·9	·318	·377	62	88	W 1	W 0-1	0	9	—	○ 9a.
28	·186	·187	50·6	51·5	43·1	69·6	·336	·318	92	84	NW 1	NW 1	0	0	—	≋ before 9a
29	·197	30·120	55·8	47·3	39·2	63·0	·315	·294	71	91	NW 1	W 1	8	0	—	
30	30·097	29·999	61·5	49·8	35·1	69·7	·340	·322	54	90	Calm 0	SE 1	1	0	·043	
Means	*30·073	30·056	48·0	44·4	36·1	57·5	·262	·264	78·4	90·0	1·0	0·9	5·4	5·0	1·502	

* 29 days.

HAWES.

Height above Mean Sea Level, 800 feet. Long. 2° 11′ W. Lat. 54° 18′ N.

MAY, 1875.

Day	Barometer.		Air Temperature.				Tension of Vapour.		Relative Humidity.		Wind, Direction and Force.				Cloud Amount.		Rain.	Remarks.
	9 a.m.	9 p.m.	9 a.m.	9 p.m.	Min.	Max.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.		9 p.m.		9 a.m.	9 p.m.	9 a.m.	
	ins.	ins.	°	°	°	°	ins.	ins.	%	%							ins.	
1	30·018	29·980	40·8	43·0	38·3	47·8	·355	·264	100	95	E	1	E	1	0	10	—	
2	30·033	·971	43·0	43·9	40·9	54·6	·362	·262	91	91	Calm	0	Calm	0	10	0	—	☂ ≡ 0 9a.
3	29·894	29·944	59·0	53·0	35·2	64·0	·387	·351	57	87	Calm	0	Calm	0	8	10	·010	☂ T 1 tarnoon.
4	29·991	30·041	55·5	49·0	47·0	60·0	·353	·295	80	85	Calm	0	Calm	0	10	10	·020	
5	30·023	29·915	54·8	51·0	43·0	61·8	·304	·343	71	92	Calm	0	ESE	1	7	10	·010	☂
6	29·746	·649	52·1	46·5	44·8	63·0	·308	·302	79	96	Calm	0	Calm	0	10	7	·140	
7	·478	·657	47·2	44·6	43·2	55·8	·294	·218	91	74	Calm	0	WNW	1	10	3	·030	
8	·716	·676	54·9	50·6	37·7	60·0	·348	·315	81	86	Calm	0	SSW	1	9	10	·150	≡ in morning.
9	29·693	29·826	53·4	50·0	46·0	57·7	·304	·315	74	87	SW	2	SW	3	6	10	·060	
10	30·060	30·320	51·0	45·0	44·8	56·3	·355	·241	68	81	W	1	SW	1	5	7	—	
11	·261	·295	47·2	51·1	40·2	51·9	·294	·357	91	95	SW	1	SW	2	10	10	·480	
12	·278	·274	49·2	50·4	47·1	52·7	·322	·361	93	98	SW	2	WNW	2	10	10	·140	≡
13	·254	·323	54·7	49·0	48·8	59·8	·335	·302	79	87	W	1	SW	2	10	0	—	
14	·277	·199	58·8	54·0	41·7	69·8	·377	·340	76	81	Calm	0	SW	1	10	0	·030	☂
15	·126	·301	54·1	46·1	46·0	61·0	·357	·227	85	73	SW	1	SE	1	9	0	—	
16	·292	30·235	51·0	46·3	39·1	64·0	·339	·240	64	77	NW	1	Calm	0	2	0	—	
17	30·056	29·841	57·0	48·0	33·9	64·4	·370	·275	58	83	Calm	0	Calm	0	0	8	·150	
18	29·553	·449	49·9	44·5	43·4	52·7	·311	·248	87	85	Calm	0	WSW	2	10	9	·070	
19	·510	·639	43·4	45·8	39·9	52·0	·246	·251	87	82	WSW	1	SW	2	8	10	·090	▲ ☂ and ● ☂ showers 8.40 a–2p.
20	·570	·606	46·3	49·9	44·3	51·0	·370	·311	87	87	SSW	2	SW	2	10	10	·510	
21	·644	·496	57·2	47·0	44·0	60·0	·365	·271	78	85	S	1	SSW	1	6	3	·340	T 7.30p.
22	·677	29·772	51·0	46·2	43·7	56·2	·338	·266	64	86	SW	2	SW	2	8	9	·200	
23	29·923	30·147	46·2	47·0	44·5	53·3	·357	·247	84	77	SW	2	W	3	10	6	·060	
24	30·300	·178	52·1	51·0	42·2	58·1	·390	·348	75	93	SW	1	SW	3	10	10	·190	
25	·349	·305	53·0	47·3	45·1	57·1	·369	·334	67	72	W	2	WSW	1	6	10	—	
26	·301	·350	49·1	44·0	40·7	59·0	·355	·344	74	84	NW	1	S	1	8	10	—	
27	30·249	30·049	51·0	52·3	35·3	54·2	·355	·308	68	79	Calm	0	NW	1	10	10	·160	
28	29·827	29·938	51·7	43·5	43·0	57·3	·334	·249	87	88	WSW	1	E	1	10	10	·060	
29	·975	30·026	43·9	38·8	38·7	51·0	·249	·203	87	86	NE	1	Calm	0	10	0	—	⌋ ☂
30	29·966	29·999	50·6	48·0	30·8	60·6	·278	·295	75	89	Calm	0	Calm	0	8	6	—	
31	30·040	30·159	57·9	53·0	34·3	68·9	·397	·325	61	81	Calm	0	Calm	0	5	0	—	☂
Means	29·727	29·986	51·2	47·7	41·5	57·9	·293	·284	78·0	85·2		0·8		1·3	7·9	6·6	2·960	

STRATHFIELD TURGISS.

Height above Mean Sea Level 196 feet. Long. 1° 0′ W. Lat. 51° 20′ N.

May, 1875.

Day.	Barometer.		Air Temperature.			Vapour.		Humidity.		Force.		Amount.		Rain.	Remarks.
	9 a.m.	9 p.m.	9 a.m.	9 p.m.	Min.	Max.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	
	ins.	ins.	°	°	°	°	in.	in.	%	%					ins.	
1	29·921	29·918	52·4	51·2	42·8	55·2	·358	·366	91	98	Calm 0	Calm 0	10	10	·093	
2	·967	·971	50·5	51·5	49·0	63·4	·333	·351	91	92	NW 1	W 1	10	3	—	
3	29·969	29·978	61·4	54·4	37·5	66·8	·355	·391	65	88	S 1	SW 1	3	10	—	
4	30·013	30·026	57·8	55·1	47·9	68·2	·378	·416	79	96	W 0-1	SW 1	10	10	—	
5	30·039	29·941	54·7	49·9	43·4	65·2	·371	·312	87	88	W 1	NW 1	4	8	·018	
6	29·812	·721	57·4	51·9	47·5	63·8	·393	·352	85	91	SW 1	SE 1	8	10	·287	
7	·582	·741	51·2	53·2	45·3	58·2	·356	·388	95	96	SW 1-2	SW 1	10	10	·099	
8	·856	·845	56·8	54·7	51·6	60·2	·446	·425	96	99	SW 1	SE 1	10	10	·316	
9	29·908	29·974	57·0	51·1	47·2	63·3	·377	·349	81	93	SW 1	W 1	8	2	—	
10	30·133	30·363	55·8	50·0	45·0	62·5	·315	·395	71	82	NW 1-2	NW 1	1	5	—	
11	·450	·426	56·6	52·0	38·9	65·2	·315	·361	69	93	NW 1	W 1	4	4	—	
12	·405	·329	59·4	54·1	40·4	70·4	·348	·355	69	85	SW 1	SE 0-1	3	0	—	
13	·334	·296	65·8	58·0	44·3	75·2	·467	·377	74	78	Calm 0	Calm 0	1	0	—	
14	·297	·219	66·2	58·0	49·0	77·2	·424	·447	66	92	Calm 0	E 0-1	0	0	—	
15	·188	·236	71·0	59·0	47·3	80·1	·518	·407	68	82	W 1	NW 1	1	0	—	
16	·253	30·203	62·3	50·9	47·0	74·2	·352	·311	63	84	E 1	E 1	3	0	—	
17	30·101	29·870	58·7	53·2	34·7	70·9	·327	·388	67	96	SE 1	SE 1	0	9	—	
18	29·626	·640	59·3	45·6	42·4	62·4	·373	·275	75	90	W 1	W 1	10	0	·013	
19	·642	·815	53·6	45·9	39·7	60·6	·290	·265	71	87	NW 1-2	NW 1	6	3	—	
20	·789	·786	53·0	52·9	40·3	57·8	·316	·370	78	93	SW 2-3	SW 1	10	10	·324	
21	·775	·702	60·0	51·9	51·7	66·2	·412	·352	80	91	S 1-2	SW 1	7	0	·126	
22	29·857	29·952	54·3	52·4	49·9	63·0	·373	·338	89	86	S 1	SW 1	5	10	·008	
23	30·134	30·338	56·3	56·4	43·3	62·9	·311	·281	69	78	SW 1	SW 1	4	0	—	
24	·446	·375	59·3	53·0	39·6	67·0	·351	·338	70	84	W 0-1	W 1	7	2	—	
25	·335	·313	61·6	53·3	42·4	69·1	·431	·370	79	91	NW 1	NW 1	8	3	—	
26	·300	·288	54·1	52·7	37·9	68·4	·319	·373	66	80	N 1-2	N 1	9	8	—	
27	30·294	30·113	55·4	53·9	41·5	63·1	·311	·346	71	83	N 1	NW 1	4	9	—	
28	29·918	29·803	61·4	52·6	46·7	64·5	·391	·394	73	100	N 1	NE 0-1	9	10	·178	towards S.
29	·852	·914	48·0	49·0	45·9	58·2	·333	·302	97	87	NE 1	NE 1	10	10	—	
30	29·952	29·954	49·8	47·8	42·3	62·9	·273	·305	77	92	NE 1	E 1	4	0	—	
31	30·035	30·114	55·4	50·0	36·6	65·0	·325	·309	74	86	NE 1	E 1	3	0	—	
Means	30·039	30·037	57·3	52·2	43·8	65·5	·361	·340	76·9	89·1	1·0	0·9	5·9	5·0	1·512	

HAWES.

Height above Mean Sea Level 800 feet. Long. 2° 11′ W. Lat. 54° 18′ N.

June, 1875.

Day.	Barometer.		Air Temperature.				Tension of Vapour.		Relative Humidity.		Wind, Direction and Force.		Cloud Amount.		Rain.	Remarks.
	9 a.m.	9 p.m.	9 a.m.	9 p.m.	Min.	Max.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	
	ins.	ins.	°	°	°	°	in.	in.	%	%					ins.	
1	30·270	30·345	61·0	50·0	37·5	67·9	·321	·281	60	79	Calm 0	SE 1	0	0	—	d 2
2	·352	30·274	56·0	47·0	34·7	65·0	·295	·275	65	86	Calm 0	Calm 0	1	1	—	] 2
3	30·122	29·992	57·0	53·9	40·1	73·0	·351	·365	75	88	E 2	E 1	0	0	—	d 2 ≋≋ on horizon.
4	29·881	·983	63·6	49·2	45·7	67·0	·443	·273	75	78	Calm 0	W 1	10	8	—	d 2
5	·977	·894	58·1	48·0	45·0	61·9	·374	·309	57	93	Calm 0	WSW 1	1	10	·080	d
6	·737	·943	56·0	55·0	48·1	58·0	·416	·397	92	92	SW 1	WSW 1	10	9	·120	
7	29·949	29·963	52·8	54·7	49·8	58·1	·361	·375	90	88	WSW 1	Wb.S 2	10	10	·220	
8	30·150	30·168	56·4	48·1	48·1	61·3	·290	·308	64	92	Wb.N 1	NW 1	7	0	—	
9	29·836	29·608	56·0	50·4	41·5	59·7	·345	·329	77	90	Calm 0	Calm 0	6	6	·490	
10	·569	·502	55·0	48·5	46·7	59·3	·350	·308	58	91	WSW 1	WSW 2	6	9	·350	
11	·492	·577	47·2	46·0	44·8	51·8	·296	·287	92	93	WSW 1	WSW 2	10	6	·390	
12	·570	·618	49·0	47·9	44·0	58·6	·288	·289	83	88	Wb.N 1	W 1	8	8	·080	
13	·640	·486	50·0	46·9	45·6	52·5	·301	·290	84	91	SW 1	Wb.S 1	10	8	·190	
14	·444	·349	52·2	48·2	41·9	58·5	·340	·260	87	77	Calm 0	SW 2	10	0	·420	
15	·200	·266	54·7	47·2	45·2	56·3	·323	·273	76	85	Sb.W 2	SW 2	6	10	·750	rla T
16	·381	·548	51·5	49·6	44·1	54·9	·306	·309	81	88	SW 2	WSW 2	5	10	·280	
17	29·781	29·958	53·0	49·5	47·2	57·5	·323	·321	80	91	WNW 1	ESE 1	10	10	·250	
18	30·051	30·146	55·7	49·0	41·0	61·0	·322	·293	73	85	Calm 0	SW 1	9	3	—	
19	30·113	29·969	54·4	55·7	40·1	64·7	·396	·406	70	91	SW 1	SW 2	10	10	·060	d 2
20	29·933	·867	56·2	46·9	46·8	61·2	·303	·276	67	87	W 1	WNW 1	3	8	—	d 2
21	29·826	29·986	54·4	48·9	42·1	61·2	·270	·287	64	84	Calm 0	Wb.N 2	9	1	—	d 2
22	30·079	30·097	55·5	52·9	43·0	58·9	·296	·375	68	94	Wb.S 1	SW 3	9	10	·010	d gp Scotch ≋≋
23	·161	·227	53·7	53·2	52·5	57·1	·325	·351	78	86	WSW 1	WSW 2	10	6	—	
24	·217	30·156	59·0	54·2	51·2	69·2	·357	·385	72	92	Wb.S 1	Calm 0	7	1	—	d gp
25	30·030	29·896	59·6	54·9	49·8	69·3	·393	·374	77	87	W 1	WSW 2	5	10	·040	d 2 gp d
26	29·836	·998	51·4	47·2	47·0	56·3	·294	·262	78	83	W 2	WSW 2	7	3	·090	
27	·974	·868	54·5	49·0	38·0	56·4	·318	·306	75	89	Calm 0	WSW 1	10	10	·100	d 2
28	·863	·940	51·6	54·1	48·2	55·7	·364	·373	95	89	Calm 0	Eb.N 1	10	10	·016	Scotch ≋≋
29	·954	·960	59·5	54·2	52·3	65·2	·386	·394	77	94	ENE 1	NE 1	10	10	·170	
30	29·866	29·792	52·9	52·0	51·2	55·2	·357	·366	89	94	NE 1	Calm 0	10	10	·290	
Means	29·875	29·879	54·9	50·4	45·1	60·3	·327	·323	76·0	88·1	0·8	1·4	7·3	6·6	4·390	

STRATHFIELD TURGISS.

Height above Mean Sea Level 196 feet. Long. 1° 0′ W. Lat. 51° 20′ N.

JULY, 1875.

Day.	Barometer.		Air Temperature.				Tension of Vapour.		Relative Humidity.		Wind, Direction and Force.				Amount of Cloud.		Rain-fall.	Remarks.
	9 a.m.	9 p.m.	9 a.m.	9 p.m.	Min.	Max.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.		9 p.m.		9 a.m.	9 p.m.	9 a.m.	
	ins.	ins.	°	°	°	°	in.	in.	%	%							ins.	
1	29·752	29·714	64·2	55·4	53·8	68·5	·500	·406	83	93	S	1	S	1	10	6	·040	
2	·754	29·817	61·8	58·4	52·0	66·9	·462	·447	84	92	SW	1	SW	0–1	9	10	·055	
3	29·913	30·064	55·3	57·5	54·3	63·9	·399	·457	91	97	NW	1	N	0–1	10	10	·305	
4	30·281	·360	55·9	53·8	53·4	63·7	·419	·385	94	93	NE	1	Calm	0	10	0	—	
5	·352	·319	63·6	57·4	44·4	72·4	·431	·427	74	90	NE	1–2	NE	1	0	0	—	
6	·331	·309	65·9	62·9	53·7	75·2	·485	·507	77	89	NE	1	NE	1	1	1	—	
7	·295	30·172	63·0	58·6	52·2	72·2	·454	·454	79	93	N	1	E	1	9	1	—	
8	30·041	29·905	60·1	58·0	53·9	69·9	·441	·461	86	95	N	1	Calm	0	10	7	—	
9	29·765	·385	57·4	57·0	53·5	68·5	·428	·451	91	97	SW	1	W	1	10	10	·542	
10	·667	·727	57·8	54·4	50·3	65·5	·324	·377	68	90	SW	1–2	NW	1–2	8	9	·053	
11	29·522	29·812	59·1	53·3	45·3	63·2	·384	·378	77	93	SW	1–2	W	1	7	2	·015	
12	30·025	30·222	55·8	53·0	49·0	65·2	·355	·352	80	87	W	2	NW	1	8	8	—	
13	·237	30·164	61·8	52·0	40·2	65·4	·403	·356	74	93	NW	0–1	Calm	0	7	10	—	
14	30·000	29·678	58·8	50·8	43·3	59·1	·404	·351	82	94	S	1	SE	1	10	10	1·624	
15	29·668	·713	56·8	57·0	50·8	59·9	·462	·434	100	93	SE	1	NE	1	10	10	·821	
16	·804	·892	57·0	56·7	54·5	63·0	·453	·421	97	91	N	1	NE	2	10	10	·023	
17	·871	·798	58·3	60·1	54·1	61·2	·441	·464	91	89	NE	1–2	NE	1	10	10	·358	
18	·747	·808	61·1	60·8	55·9	71·5	·538	·472	98	89	E	0–1	S	1	10	0	·060	
19	·841	·876	59·5	58·6	57·5	72·8	·482	·467	95	95	N	1	S	1	10	8	·023	
20	·944	·970	62·8	58·0	55·4	68·2	·482	·461	84	95	SW	1	NW	1	10	8	·011	
21	·929	·874	56·0	57·0	55·0	67·1	·389	·434	87	93	W	1	W	1	10	10	1·760	
22	·818	·766	64·1	52·0	51·8	72·7	·500	·356	83	92	NW	1–2	W	1	4	10	—	
23	·699	·672	60·0	57·0	49·4	66·3	·431	·451	84	97	W	1–2	W	1	9	7	·114	
24	·629	29·712	59·3	53·0	52·3	71·8	·489	·352	97	87	SW	1	SW	1	5	4	—	
25	29·943	30·130	63·1	53·4	43·3	67·7	·358	·343	63	84	SW	1	W	1	8	0	—	
26	—	·375	62·4	53·5	41·3	70·2	·394	·396	70	97	NW	1	Calm	0	0	6	—	
27	30·381	·342	64·0	57·3	42·8	73·0	·345	·344	58	73	SE	1	E	1	8	10	—	
28	·327	·331	67·9	60·0	45·8	75·5	·427	·395	62	76	NE	1	N	0–1	0	0	—	
29	·354	·264	68·4	61·5	45·4	77·8	·441	·479	63	88	NE	1	N	1	8	10	—	
30	·160	·225	66·0	55·6	49·7	74·3	·434	·318	68	72	NW	1	N	1	10	6	—	
31	30·175	30·130	58·0	52·0	44·1	69·0	·366	·361	76	93	NW	1–2	Calm	0	8	0	—	
Means	*29·972	29·985	60·8	56·3	49·9	68·4	·429	·412	81·2	90·3		1·1		0·9	7·7	6·2	5·704	

≋≋ in afternoon.

HAWES.

Height above Mean Sea Level 800 feet. Long. 2° 11′ W. Lat. 54° 18′ N.

JULY, 1875.

Day.	Barometer.		Air Temperature.				Tension of Vapour.		Relative Humidity.		Wind, Direction and Force.		Cloud Amount.		Rain.	Remarks.
	9 a.m.	9 p.m.	9 a.m.	9 p.m.	Min.	Max.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	
	ins.	ins.	°	°	°	°	in.	in.	%	%					ins.	
1	29·724	29·667	59·4	56·8	51·9	67·7	·449	·446	90	96	Calm 0	Calm 0	10	10	·600	*gs* ≋ *qp* ℵ
2	·635	29·786	62·2	56·3	53·6	67·1	·396	·394	71	87	Calm 0	WSW 2	6	9	·160	Aft. ≋
3	29·967	30·247	53·1	51·0	50·3	59·6	·370	·261	91	70	ENE 1	N 1	10	3	·030	
4	30·367	·420	60·8	51·6	41·6	69·3	·292	·309	55	83	Calm 0	Calm 0	0	0	—	d d² *ga.* and *qp*
5	·372	·387	65·8	60·9	42·0	70·8	·370	·441	59	83	Calm 0	ESE 1	1	10	—	d² *ga.*
6	·362	·371	67·9	62·8	52·8	73·6	·470	·482	69	84	Calm 0	Calm 0	1	10	—	d *ga.* and *qp.*
7	·331	30·318	67·1	60·9	49·2	75·7	·446	·459	67	87	Calm 0	Calm 0	0	10	—	d² *ga.* d *qp*
8	30·055	29·911	62·5	58·6	56·7	68·4	·418	·366	75	75	Calm 0	WSW 1	10	3	—	d² *ga.*
9	29·649	·353	55·0	52·6	46·9	58·9	·325	·364	75	92	Calm 0	Calm 0	10	10	·240	
10	·478	·551	55·0	48·9	48·0	57·0	·325	·321	75	93	W b. S 2	W b. S 3	9	10	·550	
11	·386	29·666	48·2	49·3	46·1	58·7	·295	·318	89	91	W b. S 1	W b. N 1	10	10	·080	
12	29·940	30·160	52·2	47·9	44·9	60·8	·283	·361	73	79	NW 2	WNW 1	10	0	—	d *qp.*
13	30·172	30·124	58·0	50·0	39·3	62·5	·289	·334	60	93	Calm 0	Calm 0	9	10	·080	d² *ga.*
14	29·988	29·896	53·0	51·9	46·2	62·2	·345	·331	85	86	Calm 0	E 2	10	10	·030	
15	29·889	30·038	54·0	50·7	50·5	61·0	·364	·327	87	88	E 2	E b. N 2	10	5	—	
16	30·064	30·087	53·9	50·2	47·8	64·8	·390	·333	70	93	E-NW 2	E-NW 1	8	5	—	d *qp.*
17	30·014	29·989	61·9	55·1	39·4	68·9	·361	·353	66	81	Calm 0	E b. S 1	1	4	·370	d² *ga.*
18	29·872	·889	55·8	55·8	53·7	59·0	·404	·436	90	98	ESE 2	E-N 2	10	10	·460	≋ *qp.*
19	·899	·938	60·1	58·9	55·7	65·2	·503	·475	97	96	E-N 1	E b. S. 1	10	10	·600	≋ *qa.*
20	·953	·988	58·5	58·0	56·8	60·8	·446	·454	92	94	E-N 1	ESE 1	10	9	·160	
21	·953	·894	64·6	59·9	55·0	70·0	·396	·327	65	63	E-N 1	ENE-N 1	8	10	·100	
22	·797	·726	59·3	56·9	51·9	66·6	·364	·407	73	88	Calm 0	W b. S 1	10	5	·010	
23	·638	·595	60·2	54·3	53·3	67·4	·428	·375	83	89	W b. S 1	WSW 2	9	10	·140	
24	·565	29·753	55·6	48·4	48·4	57·4	·302	·276	69	82	W b. S 1	WSW 3	8	1	·010	
25	29·864	30·066	53·3	48·0	42·0	58·9	·309	·281	76	85	WSW 1	WSW 2	2	7	·060	
26	30·260	·376	55·4	46·2	37·4	63·0	·273	·264	63	86	WNW 1	WNW 1	1	0	—	≋ *qp.*
27	·380	·382	61·3	58·2	38·6	68·1	·287	·342	51	71	WSW 1	Calm 0	1	10	—	d² *ga.*
28	·309	·418	63·5	54·4	46·1	70·4	·373	·361	64	85	E b. N 1	ESE 1	2	0	—	
29	·336	·200	65·0	61·9	43·0	73·1	·393	·373	63	68	Calm 0	WSW 1	1	10	·030	d² *ga.* d *qp.*
30	·153	·333	54·5	51·0	51·0	63·1	·297	·283	70	76	NW 1	W 2	2	9	—	
31	30·176	30·210	54·2	49·0	44·6	64·4	·287	·293	68	85	NW 1	Calm 0	3	0	—	d *ga.*
Mean	29·968	30·017	58·5	54·1	47·9	65·0	·360	·356	73·6	84·7	0·7	1·2	6·2	6·8	3·610	

STRATHFIELD TURGISS.

Height above Mean Sea Level 196 feet. Long. 1° 0′ W. Lat. 51° 20′ N.

JULY, 1875.

Day.	Barometer.			Thermometer.			Vapour.		Humidity.		Wind force.		Cloud.		Rain.	Remarks.
	9 a.m.	9 p.m.	9 a.m.	9 p.m.	Max.	Min.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	
	ins.	ins.	°	°	°	°	in.	in.	%	%					ins.	
1	29·752	29·714	64·2	55·4	68·5	53·8	·500	·406	83	93	S 1	S 1	10	6	·040	
2	·754	29·817	61·8	58·4	66·9	52·0	·462	·447	84	92	SW 1	SW 0–1	9	10	·055	
3	29·913	30·064	55·3	57·5	63·9	54·3	·399	·457	91	97	NW 1	N 0–1	10	10	·305	
4	30·281	·360	55·9	53·8	63·7	53·4	·419	·385	94	93	NE 1	Calm 0	10	0	—	
5	·352	·319	63·6	57·4	72·4	44·4	·431	·427	74	90	NE 1–2	NE 1	0	0	—	
6	·331	·309	65·9	62·9	75·2	53·7	·485	·507	77	89	NE 1	NE 1	1	1	—	
7	·295	30·172	63·0	58·6	72·2	52·2	·454	·454	79	92	N 1	E 1	9	1	—	
8	30·041	29·905	60·1	58·0	69·9	53·9	·441	·461	86	95	N 1	Calm 0	10	7	—	
9	29·765	·385	57·4	57·0	68·5	53·5	·428	·451	91	97	SW 1	W 1	10	10	·342	
10	·667	·727	57·8	54·4	65·5	50·3	·324	·377	68	90	SW 1–2	NW 1–2	8	9	·053	
11	29·522	29·812	59·1	53·3	63·2	45·3	·384	·378	77	93	SW 1–2	W 1	7	3	·015	
12	30·025	30·222	55·8	53·0	65·2	49·0	·355	·352	80	87	W 2	NW 1	8	8	—	
13	·237	30·164	61·8	52·0	64·2	40·2	·403	·356	74	92	NW 0–1	Calm 0	7	10	—	
14	30·000	29·678	58·8	50·8	65·4	43·3	·404	·351	82	94	S 1	SE 1	10	10	1·624	
15	29·668	·713	56·8	57·0	59·1	50·8	·462	·434	100	93	SE 1	NE 1	10	10	·821	
16	·804	·892	57·0	56·7	59·9	54·5	·453	·421	97	91	N 1	NE 2	10	10	·023	
17	·871	·798	58·3	60·1	63·0	54·1	·441	·464	91	89	NE 1–2	NE 1	10	10	·358	
18	·747	·868	61·1	60·8	61·2	54·1	·528	·472	98	89	E 0–1	S 1	10	0	·060	
19	·841	·876	59·5	58·6	71·5	55·9	·482	·467	95	95	N 1	S 1	10	8	·023	
20	·944	·970	62·8	58·0	72·8	57·5	·482	·461	84	95	SW 1	NW 1	10	8	·011	
21	·929	·874	56·0	57·0	68·2	55·4	·389	·434	87	93	W 1	W 1	10	10	1·760	
22	·818	·766	64·1	52·0	67·1	55·0	·500	·356	83	92	NW 1–2	W 1	4	10	—	
23	·699	·672	60·0	57·0	72·7	51·8	·431	·451	84	97	W 1–2	W 1	9	7	·114	
24	·629	29·712	59·3	53·0	66·3	49·4	·489	·352	97	87	SW 1	SW 1	5	4	—	
25	29·943	30·130	63·1	53·4	71·8	52·3	·358	·343	63	84	SW 1	W 1	8	0	—	
26	—	·375	62·4	53·5	67·7	43·3	·394	·396	70	97	NW 1	Calm 0	0	6	—	
27	30·381	·342	64·0	57·3	70·2	41·3	·345	·344	58	73	SE 1	E 1	8	10	—	
28	·327	·331	67·9	60·0	73·0	42·8	·427	·395	62	76	NE 1	N 0–1	0	0	—	
29	·354	·264	68·4	61·5	75·5	45·8	·441	·479	63	88	NE 1	N 1	8	10	—	
30	·160	·225	66·0	55·6	77·8	45·4	·434	·318	68	72	NW 1	N 1	10	6	—	
31	30·175	30·130	58·0	52·0	74·3	49·7	·366	·361	76	93	NW 1–2	Calm 0	8	0	—	
Means	*29·972	29·985	60·8	56·3	68·4	49·9	·429	·412	81·2	90·3	1·1	0·9	7·7	6·2	5·704	

*30 days.

HAWES.

Height above Mean Sea Level 800 feet. Long. 2° 11′ W. Lat. 54° 18′ N.

AUGUST, 1875.

Day.	Barometer.		Air Temperature.				Tension of Vapour.		Relative Humidity.		Wind, Direction and Force.		Cloud Amount.		Rain.	Remarks.
	9 a.m.	9 p.m.	9 a.m.	9 p.m.	Min.	Max.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	
	ins.	ins.	°	°	°	°	in.	in.	%	%					ins.	
1	30·243	30·291	54·9	48·4	45·7	59·0	·325	·312	76	92	Calm 0	Calm 0	10	1	—	☌ 9a. ☌ 2 ≋≋ 9p.
2	·252	·224	60·9	55·0	37·6	68·0	·358	·345	67	85	Calm 0	Calm 0	5	2	—	☌ 2 9a. and 9p.
3	·166	·205	58·7	52·2	40·9	66·0	·384	·351	78	90	Calm 0	ENE 1	10	10	—	☌ 2 ≋≋ 9a. ☿ 11.30a. ☌ ° 9p.
4	·202	·223	54·1	47·8	47·6	59·2	·333	·288	79	87	Calm 0	NW 1	10	9	—	☌ ☌ 9p.
5	·172	·168	54·0	54·4	40·4	58·0	·353	·379	84	90	N 1	E-N 1	10	10	·080	Scotch ≋≋ 9p.
6	·113	·142	55·2	54·5	53·8	61·2	·406	·381	93	90	E-N 1	E 2	10	9	·010	Scotch ≋≋ 9a. and p.
7	·133	·136	57·0	54·0	51·9	62·0	·386	·394	83	94	Eb.S 2	E-N 2	7	10	·370	
8	30·138	30·039	55·2	57·2	53·3	60·0	·413	·453	95	97	E 2	E 1	10	10	·010	
9	29·857	29·785	58·7	56·5	56·2	64·5	·475	·441	97	97	Eb.N 1	W 1	10	10	1·200	☿ ° 11.30a. ☿ ● 2 7p.
10	·788	·701	58·1	59·9	55·0	62·2	·397	·467	82	91	SW-SE 1	SW 2	10	10	·590	☿ 7p.
11	·795	·886	58·0	56·7	55·8	63·0	·409	·409	85	89	SW 2	W 3	10	10	·930	
12	·836	·742	58·1	56·6	55·0	65·7	·449	·413	93	90	Wb.N-E 1	E 1	10	10	—	≋≋° aft. and 9p.
13	·820	29·957	56·5	58·5	55·2	63·1	·406	·443	89	91	E 1	S 1	10	10	·040	
14	29·960	30·004	64·1	56·6	56·4	67·0	·456	·388	77	84	SW 1	WSW 2	7	10	—	
15	30·007	30·104	64·8	60·3	55·0	70·0	·456	·473	74	91	WSW 1	Calm 0	3	10	—	☌ 2 9a. ☌ 9p.
16	29·904	29·903	66·0	59·5	57·0	74·2	·503	·444	79	88	Calm 0	WSW 2	6	5	·040	☌ 2 ☌ 2. Morning obsns. at 8s. Evening [do. at 45′ past midnight.
17	·886	29·879	62·8	59·4	57·3	66·1	·524	·446	92	89	WSW 1	WSW 3	10	6	·180	
18	29·940	30·108	58·3	55·4	55·4	64·0	·394	·394	81	90	WSW 3	W 2	7	6	·010	o.20a. lunar ☾.
19	30·102	·236	63·0	53·2	42·2	68·0	·394	·297	69	73	Calm 0	Calm 0	5	6	—	☌ 2 9a. and 9p.
20	·235	·300	59·0	51·0	42·0	65·2	·331	·338	66	90	Calm 0	W 2	0	1	—	☌ 2 9a. ☌ 9p.
21	·266	·283	57·0	57·7	50·0	61·6	·371	·432	80	88	WSW 2	WSW 2	10	10	·130	
22	·223	30·151	59·0	57·0	56·9	66·1	·454	·400	93	86	WSW 1	WbS 2	10	10	·030	☌ 9a.
23	30·040	29·933	59·0	55·0	55·0	65·5	·413	·388	83	90	SW 2	Calm 0	10	10	·030	
24	29·812	·865	57·1	49·8	40·7	65·3	·427	·338	91	94	SW 1	Calm 0	10	0	·050	☌ 9p.
25	·713	·720	57·9	60·0	47·0	64·0	·449	·477	93	93	Calm 0	SW 4	10	10	·260	☌ 2
26	29·818	29·935	58·6	56·2	55·2	64·1	·389	·386	79	86	WSW 4	WSW 4	10	0	·040	
27	30·091	30·164	54·8	52·8	50·9	60·2	·333	·351	75	87	WSW 2	WSW 2	10	0	—	☌ 2 9p.
28	30·114	30·004	57·2	52·0	49·0	63·3	·403	·364	86	94	Calm 0	Calm 0	10	9	·070	☌ 2 8a. ☌ 9p. ≋≋ in valley.
29	29·944	29·970	53·8	54·0	49·9	65·2	·364	·369	87	88	Calm 0	WbS 1	10	8	—	☌ 9p.
30	·977	29·842	54·0	53·1	50·9	57·6	·338	·373	81	92	WSW 1	WbS 4	10	10	·890	∨ ● 2 8p.
31	29·957	30·167	54·0	52·0	47·2	62·4	·301	·328	72	84	NW 3	WbS 1	9	1	—	☌ 9p.
Means	30·025	30·037	58·1	55·0	50·8	63·0	·399	·389	82·5	89·4	1·1	1·7	8·9	7·2	4·130	

STRATHFIELD TURGISS.

Height above Mean Sea Level 196 feet. Long. 1° 0′ W. Lat. 51° 20 N.

August, 1875.

Day.	Barometer.		Air Temperature.				Tension of Vapour.		Relative Humidity.		Wind, Direction and Force.		Cloud Amount.		Rain.	Remarks.
	9 a.m.	9 p.m.	9 a.m.	9 p.m.	Min.	Max.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	
	ins.	ins.	°	°	°4	°	in.	in.	%	%					ins.	
1	30·182	30·238	56·0	53·9	40·4	71·1	·304	·344	81	83	NE 1	Calm 0	10	0	—	
2	·271	·214	60·6	52·5	41·8	70·5	·379	·375	73	96	NE 1	Calm 0	9	8	—	
3	·158	·099	60·0	52·0	46·8	72·2	·407	·356	78	93	Calm 0	Calm 0	8	10	·050	
4	·114	30·130	60·8	54·4	47·9	67·6	·415	·369	78	88	NE 1–2	N 1	9	10	—	
5	30·088	29·995	56·6	59·3	44·4	67·2	·345	·418	75	83	N 1–2	N 1	3	10	·016	
6	29·926	29·958	61·8	62·6	51·4	70·4	·496	·511	90	90	NE 1–2	NE 1	10	10	·137	♈ p.
7	29·979	30·036	61·7	61·6	58·3	66·7	·533	·528	97	96	E 0–1	Calm 0	10	10	·010	♈ a. ♒ ☿ p.
8	30·069	29·943	71·0	61·7	50·9	78·5	·526	·526	69	96	SE 1	Calm 0	7	10	·026	
9	29·779	·875	66·3	59·9	50·4	75·9	·518	·407	81	79	SW 1	SW 1	10	9	—	♉ a.
10	—	·866	64·9	61·9	57·9	72·2	·475	·494	77	90	S 1–2	SW 1	8	9	·104	
11	29·876	·953	62·8	62·0	60·3	73·6	·535	·520	94	94	W 1	SW 0–1	10	10	·032	
12	·857	29·742	65·0	63·0	59·4	71·3	·533	·505	87	88	S 1	SW 1	10	10	·264	
13	29·802	30·005	64·6	62·0	58·1	72·8	·518	·494	86	89	NW 1	SW 1	7	10	—	
14	30·056	·160	63·7	61·1	57·7	74·7	·546	·447	93	84	SW 1	W 1	10	4	—	♊ p.
15	·204	·204	68·5	61·0	57·9	76·8	·526	·501	76	94	W 1	Calm 0	10	5	—	
16	·099	·044	75·1	65·0	54·1	83·9	·603	·545	69	88	SW 1	SW 1	8	0	—	
17	·035	·038	65·3	63·5	55·0	76·2	·467	·531	76	91	W 1	SW 1–2	0	10	—	
18	·090	·159	64·5	61·5	58·0	75·6	·454	·522	75	96	W 1–2	SW 1	10	9	·115	
19	·206	·159	60·5	60·3	52·4	71·5	·477	·507	91	97	Calm 0	N 0–1	10	10	·416	☔ ☿ a.
20	·231	·318	59·9	59·5	52·6	74·0	·479	·472	94	93	N 0–1	N 0–1	10	0	—	♒ ☽a.
21	·386	·335	63·5	57·1	47·4	72·3	·443	·415	76	88	W 0–1	NW 1–0	9	10	—	♒ ○ a.
22	·298	30·210	60·1	55·0	49·2	74·6	·425	·391	83	91	Calm 0	W 0–1	7	0	—	
23	30·139	29·985	66·5	53·9	45·9	74·0	·451	·381	70	92	SW 0–1	SW 0–1	5	0	—	
24	29·915	·987	64·0	60·6	45·9	74·6	·431	·447	72	85	W 1	NW 0–1	10	4	—	☿ a.
25	29·900	29·956	65·1	61·1	50·2	73·2	·428	·469	70	87	SW 1	SW 1	10	0	—	
26	30·002	30·078	64·6	61·5	50·4	73·9	·518	·522	86	96	SW 1	SW 1	10	10	—	
27	·171	30·173	64·7	54·4	48·5	73·2	·451	·396	74	93	N 1	N 0–1	7	3	—	○
28	30·103	29·958	57·4	57·1	50·2	65·3	·431	·457	92	98	Calm 0	Calm 0	10	10	·180	
29	29·949	30·039	58·8	55·5	53·3	71·2	·419	·401	85	91	NW 0–1	NW 1	7	7	—	☿ in afternoon.
30	30·113	·100	60·4	54·1	48·4	68·2	·447	·362	86	87	NW 1	W 0–1	10	0	—	
31	30·077	30·187	62·7	54·3	51·1	70·8	·351	·338	62	80	NW 1–2	N 1	0	0	—	♃ a.
Means	*30·069	30·067	63·1	58·8	52·0	72·7	·464	·450	80·5	90·2	0·9	0·6	8·2	6·4	1·349	

* 30 days only.

HAWES.

Height above Mean Sea Level 800 feet. Long. 2° 11′ W. Lat. 54° 18′

SEPTEMBER, 1875.

Day.	Barometer.		Air Temperature.				Tension of Vapour.		Relative Humidity.		Wind, Direction and Force.		Cloud Amount.		Rain.	Remarks.
	9 a.m.	9 p.m.	9 a.m.	9 p.m.	Min.	Max.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	
	ins.	ins.	°	°	°	°	in.	in.	%	%					ins.	
1	30·243	30·195	57·0	59·1	37·8	68·7	·338	·454	72	91	Calm 0	Calm 0	5	10	·060	☌ ☿ 9a.
2	30·128	29·948	59·0	58·5	57·9	66·0	·467	·465	94	95	SSW 1	SSW 2	10	9	1·090	☿ in aft. Morning obsns. at 5a.
3	29·768	29·981	57·0	53·2	52·9	60·0	·415	·345	89	85	WSW 3	Wb.N 2	10	10	·070	[Evening do. at 10.30p.
4	30·034	30·075	55·0	55·6	52·0	59·1	·349	·373	81	84	Wb.S 2	WSW 2	10	10	—	
5	·204	·307	58·2	56·6	55·6	66·5	·384	·410	79	89	WNW 1	Calm 0	9	10	—	☌ ☿ ≋ 9p.
6	·306	30·230	59·4	58·0	55·9	64·4	·428	·447	85	93	WSW 1	Calm 0	10	10	—	☌ ☿ ≋ 9a. and 9p.
7	30·083	29·927	65·1	63·5	54·3	70·9	·435	·421	70	73	Calm 0	SSE 2	1	1	—	☌ ☿ 9a.
8	29·938	·850	62·0	55·4	55·3	64·8	·427	·427	77	97	Sb.E 1	sb.E-NW 1	9	10	1·350	☾ ● 9a.
9	·799	29·934	56·7	45·3	45·2	64·4	·319	·281	70	93	W 1	Calm 0	2	0	—	☌ ☿ 9a.
10	29·981	30·105	60·0	50·0	37·4	65·4	·360	·345	69	96	Calm 0	NW-SW 1	0	4	—	8.30p. ☾ ☿ ≋ 9a.
11	30·242	·397	59·9	46·2	38·7	72·0	·356	·287	69	93	Calm 0	Calm 0	0	0	—	☌ ☿ ≋ 9a. and 9p.
12	·415	·430	57·0	50·0	39·1	71·0	·360	·309	77	87	Calm 0	Eb.N 1	0	0	—	☌ ☿ ≋ 9a. and 9p.
13	·373	·399	62·0	49·5	39·4	68·8	·364	·313	68	89	Calm 0	ESE 1	0	0	—	☌ ☿ ≋ 9a. ☌ ☿ 9p.
14	·380	·360	57·0	54·2	45·8	66·6	·374	·379	80	91	Eb.S 1	E 2	6	10	—	9a. and 9p.
15	·338	·306	57·9	55·0	51·2	63·2	·370	·409	78	94	E 1	Eb.S 1	9	10	—	
16	·238	·218	58·9	51·9	51·2	65·5	·389	·336	79	87	Eb.N 2	ESE 3	4	9	·070	
17	·163	·163	56·0	55·4	51·1	70·0	·413	·427	92	97	ESE 1	ESE 1	10	7	·040	☾ ≋ 7.30p. ☌ ≋ 9p.
18	·197	·200	53·9	52·0	46·9	60·0	·416	·356	100	92	Calm 0	Eb.S 1	10	10	·030	☌ ☿ ≋ 9a. after part of day.
19	30·122	30·015	58·2	53·1	49·1	66·6	·401	·399	82	98	ESE 1	Calm 0	5	1	·160	☌ ☿ 9a. ☾ S. to W. at 7.30p. Meteors [at 8p. ☾ ☿ 9p.
20	29·921	29·932	57·4	52·0	51·7	64·2	·421	·366	89	94	WSW 1	SW 1	10	6	·250	☾ ☿ 1.15a–1.30a. Meteors to NW.9p.
21	·898	29·852	58·2	52·0	51·5	68·7	·421	·385	87	99	Calm 0	E 1	10	10	·100	≋ 4.30p. and 9p.
22	29·842	30·121	50·2	47·0	46·9	53·5	·339	·353	91	79	E 2	Eb.S 2	10	6	—	Scotch ≋
23	30·192	30·219	47·8	46·0	38·9	52·1	·288	·262	87	85	Eb.S 1	E 2	10	10	·170	
24	30·168	29·987	48·7	49·9	44·7	51·6	·318	·313	93	88	Eb.S 2	Eb.S 4	10	10	·080	☌ ≋ 9a. Earthquake 10p. for 3 [seconds.
25	29·753	·930	58·0	50·2	49·1	60·4	·437	·329	91	91	SSW 2	Calm 0	10	3	·380	☾ 8p.
26	·694	·317	54·8	57·0	48·6	59·0	·377	·374	88	80	SSW 2	S 3	10	9	·370	Meteors to SE 7.30p.
27	·278	·594	50·0	47·9	45·3	58·0	·292	·276	81	84	Wb.S 1?	WSW 4	9	1	·850	☾ ● 1.30a.–8a. ▲ ☿ ● ☿ in aft.
28	·518	·644	50·7	44·9	44·8	53·1	·284	·251	77	85	Wb.S 4	Wb.N 3	2	0	·030	[☾ 9p.
29	·725	·710	49·0	48·6	42·6	54·7	·296	·300	86	88	Wb.S 4	W 2	9	9	·210	

STRATHFIELD TURGISS.

Height above Mean Sea Level 196 feet. Long. 1° 0′ W. Lat. 51° 20′ N.

SEPTEMBER 1875.

Day.	Barometer.		Air Temperature.				Tension of Vapour.		Relative Humidity.		Wind. Direction and Force.			Cloud Amount.		Rain-fall.	Remarks.
	9 a.m.	9 p.m.	9 a.m.	9 p.m.	Min.	Max.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.		9 p.m.	9 a.m.	9 p.m.	9 a.m.	
	ins.	ins.	°	°	°	°	in.	in.	%	%						ins.	
1	30·295	30·266	62·2	61·1	41·4	71·2	·396	·483	71	90	NW	1	W 1-2	10	10	—	☾ p.
2	·354	·167	63·3	60·0	58·5	71·7	·485	·437	84	85	SW	0-1	S 1	10	6	—	
3	·020	·107	62·5	56·1	56·1	69·4	·487	·388	86	86	S	1-2	NW 1	10	0	·126	
4	·134	·196	63·4	55·5	48·0	68·4	·393	·374	67	85	NW	1	NW 1	3	8	—	
5	·367	·316	61·3	53·5	44·7	71·3	·427	·370	80	91	N	1	N 0-1	9	0	—	
6	·332	·256	65·7	52·4	45·6	73·4	·496	·379	79	96	SE	0-1	Calm 0	0	0	—	
7	30·144	30·009	67·9	60·0	44·9	75·7	·479	·453	70	88	SE	1	S 0-1	0	0	—	
8	29·931	29·773	64·1	62·7	50·3	76·6	·537	·503	90	89	Calm	0	SE 1	10	10	—	
9	·942	29·946	58·5	52·4	49·0	69·3	·362	·353	75	89	W	1	SW 1	0	0	·013	
10	29·955	30·035	55·0	49·1	40·6	68·6	·375	·333	87	96	NE	0-1	Calm 0	0	10	—	○ mid-day. ≋ gp.
11	30·179	·295	49·5	56·5	40·0	70·1	·309	·443	89	97	Calm	0	SE 0-1	10	0	—	≋ gs and before.
12	·329	·387	59·7	57·6	50·0	71·0	·401	·461	91	97	E	1	E 1	10	0	—	
13	·264	·225	58·4	62·2	56·5	76·1	·457	·462	94	83	E	1-2	E 1	10	0	—	Fine meteor due N. 8.30p.
14	·218	·196	64·7	56·3	56·3	72·0	·459	·394	75	87	NE	1	NE 0-1	5	0	—	
15	·174	·146	63·3	53·4	53·0	70·3	·456	·364	79	89	NE	2	E 1	8	0	—	
16	·093	·088	62·0	55·3	42·4	73·9	·431	·355	78	81	NE	1	E 1	0	0	—	
17	·091	·090	63·9	56·7	47·3	77·5	·505	·454	86	99	E	1	Calm 0	9	1	—	
18	·072	·020	62·7	62·0	51·0	81·4	·545	·503	96	91	Calm	0	SE 1	10	1	—	≋ gs.
19	·001	30·010	65·9	59·4	54·0	78·5	·512	·492	81	98	E	0-1	S 1	10	10	·450	≋ gs. ☈ ● 2 in afternoon.
20	30·014	29·976	63·7	56·7	52·6	70·6	·494	·444	85	96	W	1	SW 1	4	5	·135	≺ in afternoon.
21	29·956	·823	59·2	59·0	55·5	65·2	·483	·467	97	94	E	1	SE 1	10	10	·524	≋ gs.
22	29·725	29·952	63·8	60·4	60·0	72·4	·533	·511	90	98	W	1	NE 1	10	10	·064	
23	30·123	30·124	54·1	53·5	52·2	61·2	·410	·404	98	99	E	0-1	E 0-1	10	10	·264	≺ p
24	30·116	29·980	55·6	58·6	51·6	60·7	·396	·451	89	92	E	1	SE 1	10	10	·024	≺ 2 p.
25	29·877	30·056	62·7	52·2	51·9	68·5	·589	·369	93	95	SW	1	NW 0-1	10	0	—	
26	·940	29·588	59·5	63·0	49·5	67·4	·461	·505	91	88	S	1	S 1-2	10	10	·035	/ /
27	·722	·889	56·9	51·1	48·7	63·5	·353	·329	76	87	W	1	NW 1	4	0	·056	
28	·771	·750	56·3	52·0	50·3	61·4	·415	·382	91	99	W	1-2	W 1	10	2	·354	
29	29·876	29·907	56·1	52·4	44·2	63·6	·334	·325	75	83	W	1	NW 1	0	0	—	
30	30·038	30·090	56·0	49·4	47·2	63·4	·338	·338	75	96	NW	1-2	W 1	1	10	·013	
Means	30·061	30·052	60·6	56·3	49·8	70·1	·444	·418	85·9	91·5		0·9		6·8	4·1	1·957	
													0·8				

HAWES.

Height above Mean Sea Level 800 feet. Long. 2° 11′ W. Lat. 54° 18′ N.

October, 1875.

Day.	Barometer.		Air Temperature.				Tension of Vapour.		Relative Humidity.		Wind, Direction and Force.		Cloud Amount.		Rain.	Remarks.
	9 a.m.	9 p.m.	9 a.m.	9 p.m.	Min.	Max.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	
	ins.	ins.	°	°	°	°	in.	in.	%	%					ins.	
1	29·797	29·694	57·2	51·9	47·8	63·0	·403	·336	86	87	WSW 1	WSW 2	10	10	·200	
2	·662	·763	50·9	43·7	41·7	53·1	·286	·347	77	86	W 2	Wb.S 2	2	0	·160	
3	·733	·474	48·9	51·5	42·4	52·5	·301	·328	88	87	WSW 2	WSW 2	10	10	·180	
4	·583	·709	51·7	58·0	48·0	60·2	·355	·454	92	94	Wb.S 3	SW 3	10	9	·270	Scotch ≋ 9p.
5	29·764	29·927	53·7	48·5	48·3	58·2	·339	·355	82	75	W 5	WSW 4	10	1	·040	in past night.
6	30·196	30·225	48·7	49·6	46·4	51·0	·273	·281	80	80	W 5	WSW 4	5	2	·040	in past night. 9a. 9p.
7	·125	30·238	52·0	53·4	49·0	54·7	·340	·356	87	90	W 6	SW 3	7	10	·120	in past night.
8	30·050	29·868	51·9	49·9	49·4	55·0	·339	·288	88	81	SSW 2	S 2	10	8	—	
9	29·719	·754	43·2	42·9	41·6	50·4	·250	·343	89	88	NW 1	NW 1	10	10	·080	
10	·807	·428	44·7	44·8	35·5	49·5	·227	·273	77	92	WSW 1	S 3	2	10	·530	9a.
11	·177	·256	44·0	39·5	35·3	49·8	·252	·224	87	93	WSW 2	Wb.N 1	10	8	·010	
12	·331	·396	39·7	34·9	29·3	47·8	·227	·190	93	94	Calm 0	Calm 0	8	10	—	2 in past night.
13	·338	·399	34·8	36·0	25·8	49·4	·184	·204	91	96	Calm 0	Calm 0	9	2	—	2 in past night. ≋ 9a.
14	·425	·592	39·8	44·5	32·4	47·4	·229	·275	94	94	WSW 1	E–N 2	10	10	·450	
15	·704	·765	45·2	42·2	42·0	49·3	·263	·247	88	92	E–N 2	Calm 0	10	9	·020	
16	·720	·754	45·0	45·7	41·7	49·0	·264	·297	89	97	NW 1	Calm 0	10	10	·060	
17	·814	·913	44·9	43·7	41·5	50·3	·272	·269	92	94	ESE–SW 1	ESE 1	10	10	·040	≋ 9a. and 9p.
18	·923	·903	47·9	43·0	43·0	48·4	·316	·275	95	99	Eb.S 3	Eb.S 4	10	10	·550	
19	·882	·844	41·0	42·1	40·1	44·8	·239	·266	94	99	ESE 3	Eb.S 3	10	10	1·020	
20	·701	·502	42·7	43·3	42·0	43·5	·248	·278	90	100	Eb.S 3	E 3	10	10	·580	
21	·518	·474	47·1	48·1	43·3	54·9	·322	·304	99	91	SE 1	SE 2	8	10	·210	≋ 9a.
22	·529	·522	46·9	45·0	44·0	50·3	·293	·295	92	98	ESE 1	ESE 1	10	10	·590	≋ 9a.
23	29·526	29·813	48·8	46·2	45·1	50·0	·335	·308	97	99	E 1	E 2	10	10	·390	
24	30·062	30·202	45·9	38·8	37·7	49·4	·263	·219	86	94	Eb.S 1	Calm 0	1	0	—	
25	·220	30·181	37·3	34·9	32·4	51·9	·211	·200	95	99	Calm 0	Calm 0	0	0	—	2 in morning. ≋ all day. 9p.
26	30·067	29·954	44·2	42·0	33·5	46·0	·241	·217	83	82	S–E–N 1	ESE 2	10	9	—	d 2 ≋ 9a.
27	29·855	29·905	42·3	39·4	39·0	43·3	·225	·214	84	89	ESE 3	Eb.N 3	10	6	—	
28	30·033	30·118	41·3	40·0	38·0	44·3	·230	·237	89	96	ESE–ENE 1	E 2	6	10	·060	
29	·174	30·124	41·3	39·7	39·1	44·3	·238	·230	92	94	ESE 2	E 1	10	10	·050	
30	30·044	29·985	39·6	38·2	38·0	41·0	·204	·210	84	92	ESE 3	E 2	10	10	·040	
31	29·959	29·974	37·5	39·0	36·1	39·2	·220	·221	99	94	Eb.N 1	E 1	10	10	·060	
Means	29·788	29·793	45·2	43·9	40·3	49·7	·271	·266	89·0	91·8	1·9	1·9	8·6	8·2	5·650	

STRATHFIELD TURGISS.

Height above Mean Sea Level 196 feet. Long. 1° 0′ W. Lat. 51° 20′ N.

October, 1875.

Day.	Barometer.		Air Temperature.			Tension of Vapour.		Relative Humidity.		Wind, Direction and Force.			Cloud Amount.		Rain.	Remarks.
	9 a.m.	9 p.m.	9 a.m.	9 p.m.	Min.	Max.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	
	ins.	ins.	°	°	°	°	in.	in.	%	%					ins.	
1	29·999	29·903	57·8	59·2	48·4	63·9	·430	·482	89	96	SW 0-1	W 1	10	10	·120	♅ 9p.
2	·735	·935	57·8	48·0	47·0	59·4	·424	·307	88	92	W 0-1	NW 1	9	0	·313	
3	·948	·698	51·0	55·9	43·0	61·0	·343	·416	92	93	SW 0-1	SW 1	10	10	·156	
4	29·752	29·965	60·4	61·7	53·8	65·3	·483	·518	93	95	W 1-2	W 1	10	10	—	
5	30·002	30·193	61·6	51·5	51·0	69·5	·492	·349	90	92	SW 1	NW 1	9	0	—	
6	·440	·504	54·3	45·5	42·2	61·3	·311	·293	74	97	NW 1	NW 1	0	0	—	
7	·425	30·375	55·4	54·0	44·3	62·9	·362	·371	83	89	W 1	Calm 0	2	10	—	↙ in afternoon.
8	30·189	29·874	56·4	49·3	42·4	61·6	·377	·339	83	97	S 1	SE 1	9	7	—	↙ in afternoon.
9	29·701	·803	54·7	44·0	42·5	57·5	·384	·265	90	92	SE 0-1	NW 2-3	8	10	·733	↙ 2 at night.
10	·959	·702	49·1	50·1	35·6	55·6	·278	·323	80	89	W 1	SW 1	0	10	·268	
11	·334	·313	48·7	38·3	38·0	55·4	·287	·230	84	100	W 1	Calm 0	1	0	—	9p.
12	·365	·445	40·4	35·0	29·4	55·2	·236	·204	95	100	Calm 0	Calm 0	0	0	—	≡ 9p.
13	·220	·268	41·5	39·8	31·0	52·2	·257	·235	98	96	SE 0-1	NE 0-1	9	0	—	≡ 9a.
14	·320	·324	43·4	48·2	36·8	49·2	·263	·322	94	96	N 1-2	NE 1-2	10	10	·174	≡ 9a.
15	·520	·661	50·5	44·6	43·3	52·9	·333	·273	89	93	N 1-2	N 1	7	0	—	♁ a.
16	·734	·780	43·5	35·5	35·0	55·1	·269	·208	95	100	NW 1	NW 1	10	0	—	♁ a.
17	·787	·824	47·3	51·6	31·7	58·2	·308	·366	95	96	SE 0-1	SE 0-1	7	9	—	♁ a.
18	·819	·731	50·4	51·7	47·4	56·1	·322	·344	88	89	SE 1	SE 2	9	9	·550	↙ all night.
19	·719	·671	49·0	50·8	48·6	52·9	·348	·358	100	96	SE 1	SE 1	10	10	1·820	
20	·510	·484	48·5	47·9	47·0	51·1	·342	·311	100	94	E 1	NW 1	10	10	·346	
21	·547	·555	56·4	48·8	46·2	60·1	·401	·339	89	95	S 1	NW 1	3	0	·246	
22	·518	·490	52·8	45·4	41·9	55·4	·382	·294	95	97	S 1	SE 1	10	0	1·098	↙ at night.
23	·373	29·616	47·9	49·1	46·5	51·3	·322	·336	97	96	SW 0-1	Calm 0	10	9	·015	
24	29·976	30·185	49·4	46·0	43·1	52·1	·293	·287	84	93	NE 1	E 1	6	8	—	
25	30·232	30·190	44·1	44·4	33·5	53·1	·248	·273	85	94	E 1	E 1	1	0	—	
26	30·108	29·993	47·6	44·1	41·4	52·4	·333	·279	71	97	SE 1	SE 1-2	8	10	·370	
27	29·735	·703	41·4	42·2	40·0	48·8	·240	·260	93	96	E 0-1	E 1	10	10	·310	
28	29·868	29·976	45·3	46·4	37·5	47·9	·283	·306	94	97	NE 1	SE 1	10	10	·120	
29	30·078	30·064	43·7	42·2	36·8	48·6	·264	·233	92	87	E 1	Calm 0	7	8	—	
30	29·998	29·917	42·1	41·6	39·8	43·3	·207	·202	78	78	E 1	E 1	10	10	—	
31	29·890	29·921	43·2	35·3	35·0	43·2	·230	·199	82	97	E 0-1	NE 0-1	10	0	—	
Means	29·800	29·806	49·5	46·7	41·3	55·2	·321	·307	89·0	94·2	0·9	0·9	7·3	5·8	6·939	

HAWES.

Height above Mean Sea Level 800 feet. Long. 2° 11′ W. Lat. 54° 18′ N.

NOVEMBER, 1875.

Day.	Barometer.		Air Temperature.				Tension of Vapour.		Relative Humidity.		Wind, Direction and Force.		Cloud Amount.		Rain.	Remarks
	9 a.m.	9 p.m.	9 a.m.	9 p.m.	Min.	Max.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	
	ins.	ins.	°	°	°	°	in	in.	%	%					ins.	
1	29·949	29·919	38·0	36·9	35·6	40·3	·217	·186	95	86	ESE 1	ESE 1	10	10	·010	
2	·867	·789	40·0	40·8	36·0	42·7	·208	·255	85	100	ESE 1	NE 2	10	10	·590	
3	·733	·714	49·5	53·4	40·5	53·6	·344	·364	98	89	ESE 1	SSW 1	10	10	·080	≡ gz and during day.
4	·710	·859	50·7	42·3	41·9	53·9	·331	·266	89	99	WSW 2	SSW 1	8	0	·010	☂ gp.
5	·684	·468	48·7	48·4	41·6	54·3	·318	·288	93	85	WSW 1	Wb.S 4	10	0	·540	≡° gz.
6	·692	·139	47·9	46·2	45·5	50·9	·334	·277	100	90	Calm 0	Wb.N 1	10	10	·510	≡
7	·268	·272	39·0	33·3	33·3	46·8	·199	·179	84	95	Wb.S 3	Wb.S 2	0	8	·010	]° gp.
8	·373	·495	32·8	32·5	31·3	40·9	·149	·158	80	87	W 2	W 2	0	1	·010	]° during past night.
9	29·434	·330	26·8	33·5	24·0	35·4	·117	·183	81	96	Wb.N 1	Calm 0	1	10	·190	✳° in past night. ≡ gp.
10	28·904	·117	36·1	35·1	32·5	37·0	·208	·188	98	92	NNE 2	E 2	10	10	·080	✳° on hills, gp.
11	29·188	·302	36·8	40·5	34·9	44·6	·184	·226	85	90	NNW 2	W 2	9	9	·080	
12	·786	·998	36·0	39·0	28·8	46·0	·174	·137	82	86	Wb.S 1	Wb.N 1	0	0	—	⌊ gz. ⌊ ⊓ (large) gp.
13	29·811	·344	35·0	40·0	27·0	40·0	·193	·245	95	99	E 1	E 3	10	10	2·470	≡
14	28·945	29·851	44·4	35·5	35·1	45·0	·280	·182	96	88	NNE 2	W 4	10	2	·700	/
15	30·144	30·205	37·7	33·1	31·3	45·2	·193	·186	85	99	NW 1	Calm 0	1	0	·020	⌊ gz. ≡ ⌊° ⊓ (large) gp.
16	29·979	29·762	43·0	46·0	31·9	46·0	·226	·284	82	92	SW 1	SW 2	10	6	·230	≡° in aft. [≡ Midt.
17	·916	·696	45·7	52·0	43·8	52·0	·266	·361	87	93	SW 2	SW 3	10	10	·710	/ gp.
18	·903	·863	51·5	50·9	50·0	52·5	·346	·336	91	91	Wb.S 5	SW 4	10	10	·750	/ / in past night. / / gp.
19	29·406	29·993	47·7	39·2	39·1	52·0	·292	·196	89	82	SW 6	N 4	10	1	·020	/ / in past night.
20	30·155	30·170	31·8	31·4	30·1	39·7	·148	·152	82	87	NNW 3	NNW 3	1	0	·020	
21	·153	·209	35·6	35·9	29·9	39·1	·177	·186	85	88	NNE 2	NE 1	3	9	·080	[during day. ✳° ●° showers ✳° (small) in past night.
22	·362	·360	35·4	35·6	33·9	37·2	·170	·177	82	85	NE 1	NE 1	10	10	·080	●° ✳° gp.
23	·374	·348	36·5	36·1	33·3	39·1	·184	·196	86	93	NE 1	E 1	10	10	·100	✳ ● in past night.
24	·365	·271	34·7	33·1	33·0	36·9	·169	·163	83	87	ESE 2	E 1	10	10	·030	✳° showers during day.
25	·179	·161	32·8	27·5	26·0	34·0	·159	·131	86	88	NE 1	NE 1	9	5	·060	✳° in past night. ✳ gz. ✳ (large) in showers during day.
26	·060	·110	31·1	32·7	27·2	33·5	·164	·170	95	92	NNE 1	E 1	7	9	·310	✳°(small) in past night. ✳° during day.
27	·201	·295	33·3	34·9	30·2	34·9	·184	·181	97	89	Eb.N 1	E 2	9	10	·030	✳ in past night & during day. ≡ with
28	·338	·277	33·7	32·0	32·0	35·0	·144	·141	74	77	Eb.N 1	Eb.N 1	10	4	·010	[thaw in aft.
29	·205	·162	32·4	32·3	30·0	33·8	·170	·154	93	84	Eb.N 1	ENE 1	10	9	·060	✳° (small) in evening. [and evening.
30	30·114	30·072	30·9	32·2	29·0	32·7	·158	·170	91	94	ENE 1	Eb.N 3	9	10	·020	≡° on hills, gz. ✳ 9-32. ✳ ✳ [showers during day.
Means	29·820	29·854	38·5	37·7	34·0	42·5	·214	·211	88·3	90·1	1·7	1·9	7·6	6·8	7·810	

STRATHFIELD TURGISS.

Height above Mean Sea Level 196 feet. Long. 1° 0′ W. Lat. 51° 20′ N.

NOVEMBER, 1875.

Day.	Barometer.		Air Temperature.				Tension of Vapour.		Relative Humidity.		Wind. Direction and Force.		Cloud Amount.		Rain.	Remarks.
	9 a.m.	9 p.m.	9 a.m.	9 p.m.	Min.	Max.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	
	in.	in.	°	°	°	°	in.	in.	%	%					ins.	
1	29·897	29·894	41·5	42·8	30·1	46·6	·248	·231	95	85	NE	E 1	10	10	—	
2	·880	·829	45·3	52·1	41·5	52·2	·246	·375	82	96	SE	S 1	10	10	·070	
3	·793	·845	54·0	54·3	52·1	55·1	·412	·413	99	98	SE	S 1	10	10	·063	
4	·852	·915	52·9	48·3	45·0	60·1	·396	·331	99	98	SW	S 0-1	10	10	—	
5	·928	·690	50·7	56·3	43·2	57·1	·356	·430	96	95	Calm	W 0-1	10	9	·454	
6	·214	·282	53·4	49·1	42·4	57·5	·343	·308	84	89	W	W 2-3	9	0	·256	in morning.
7	·496	·226	44·6	44·4	37·6	50·4	·260	·280	89	96	W	W 1-2	4	10	·433	
8	·362	·634	40·3	35·6	33·6	47·3	·209	·184	84	89	NW	N 1	0	0	—	
9	29·458	·187	33·5	50·2	29·4	52·4	·189	·336	99	93	NE	SW 1	10	9	·374	♃. ☿p.
10	28·710	·034	46·9	44·5	44·0	54·6	·304	·284	95	97	NW	E 1	10	10	·507	in morning.
11	29·104	·640	41·8	39·3	37·0	46·7	·247	·207	94	87	NW	NW 1	10	10	—	☾a.
12	·851	·974	38·9	37·3	36·5	51·4	·225	·213	95	95	W	SE 1	4	4	·353	☾. ♆ in evening.
13	·670	·413	43·9	53·6	35·4	57·1	·271	·397	95	97	SE	SW 2-3	10	10	·477	☾p.
14	29·060	29·839	47·4	44·4	30·8	57·0	·262	·280	81	96	W	NW 2-1	10	0	·023	
15	30·226	30·223	35·4	34·4	31·7	49·0	·199	·199	96	100	Calm	Calm 0	0	0	—	♒p.
16	·104	29·914	44·7	48·3	31·5	52·4	·254	·327	86	97	SE	SW 1	6	5	·313	☾p.
17	·083	30·026	43·7	53·4	42·9	55·2	·273	·388	96	95	SW	NW 1	10	10	·076	☾a. ☾p.
18	30·115	30·140	53·0	53·1	52·6	58·3	·353	·334	87	82	NW	W 1	8	10	·008	☾p.
19	29·749	29·841	53·8	48·1	45·6	54·8	·395	·306	78	91	W	NW 2-3	9	10	—	☾a. and p
20	30·065	30·078	36·9	33·9	33·9	48·1	·145	·144	68	74	NW	N 1-3	3	10	—	
21	·000	·115	36·6	37·9	33·6	43·4	·180	·189	84	83	N	N 1-2	10	10	—	
22	·186	·183	37·5	36·0	35·4	42·2	·203	·174	91	82	N	N 1	8	0	—	☾a.
23	·232	·197	37·7	38·8	36·0	44·1	·216	·211	96	90	N	NE 1	7	10	—	
24	·206	·131	37·9	35·6	33·7	41·3	·209	·172	92	83	NE	NE 1	10	10	—	
25	·073	·049	35·0	26·5	28·3	38·9	·163	·111	79	79	NE	NE 1	10	0	—	
26	·001	·041	32·4	31·4	26·0	36·4	·176	·167	97	95	NE	N 1	10	10	—	☾a.
27	·035	·110	33·5	36·0	31·4	36·8	·168	·192	88	91	N	N 1	9	10	·025	☾a.
28	·153	30·119	34·0	33·7	33·0	36·0	·189	·162	97	84	NE	NE 1-2	10	10	—	
29	30·016	29·954	34·0	30·0	29·0	36·1	·146	·145	74	86	NE	NE 1-2	9	5	—	
30	29·906	29·871	31·7	27·8	27·8	32·8	·157	·133	86	88	E	E 1-2	10	10	—	☾p.
Means	29·814	29·846	41·8	41·9	36·2	48·3	·244	·254	89·4	90·4		1·1	8·2	7·4	3·422	

HAWES.

Height above Mean Sea Level 800 feet. Long. 2° 11′ W. Lat. 54° 18′ N.

DECEMBER, 1875.

Day.	Barometer.		Air Temperature.				Tension of Vapour.		Relative Humidity.		Wind, Direction and Force.		Cloud Amount.		Rain.	Remarks.
	9 a.m.	9 p.m.	9 a.m.	9 p.m.	Min.	Max.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	
	ins.	ins.	°	°	°	°	in.	in.	%	%					ins.	
1	30·110	30·104	31·9	32·2	31·2	32·7	·159	·160	88	88	ENE 3	NE 1	10	10	·010	⚹ °(small) *ga.* ⚹ ° ✢ during day. [⚹ °*gp.*
2	29·984	29·965	32·5	32·0	29·8	33·0	·148	·172	81	95	Nb.E 2	NE 1	10	10	·950	⚹ *ga.* ⚹ ° ⁂° on hills, and ✢ ° during day.
3	·927	29·843	32·6	31·0	27·1	33·7	·163	·146	89	84	NNE 1	WSW 1	10	3	·010	[during day. ⚹ *gp.*
4	29·935	30·132	32·0	29·5	27·9	33·9	·167	·124	92	76	NE 1	NE 1	9	4	·060	⚹ °*ga* and before. ⚹ showers in day.
5	30·192	·239	27·5	25·2	21·5	30·2	·125	·088	85	65	Eb.N 1	Eb.N 1	10	2	·310	⚹ in night and *ga.* ✢ °*gp.*
6	·348	·489	29·2	29·3	23·3	30·1	·136	·127	84	78	ENE 1	ENE 2	10	10	·010	⚹ in night and at *ga.* ⁂ on hills. [✢ *ga.* ⚹ ° ✢ °*gp.*
7	·525	·503	31·0	31·3	28·0	32·4	·107	·146	62	84	NNE 1	NNW 1	9	10	—	
8	·526	·477	29·7	31·9	29·0	32·4	·137	·175	77	97	NW 1	NW 1	10	9	·010	⁂° on hills during day.
9	·475	·442	32·0	37·0	27·0	37·5	·158	·187	87	85	WSW 1	Wb.N 1	1	8	·010	⚹ ° in past night, and during day.
10	·330	·180	37·5	40·0	32·0	40·0	·189	·211	85	86	Wb.N 1	WNW 2	10	10	·130	
11	·119	·101	40·9	41·1	39·4	42·6	·238	·211	94	82	WNW 2	Wb.N 1	10	8	·010	
12	·083	·121	41·2	40·2	40·0	43·0	·218	·228	85	92	W 2	Calm 0	10	10	—	
13	·154	·189	41·0	38·9	38·1	42·0	·235	·184	92	79	Wb.S 1	Wb.N 1	10	10	·010	
14	·150	·129	33·7	27·2	27·1	41·2	·160	·122	82	84	SW 1	Calm 0	0	0	—	⁂ in valley. └ *gp.*
15	·152	·126	20·3	33·1	18·6	33·1	·085	·182	78	97	Calm 0	SW 1	0	10	—	⁂ └² *ga*, and during day. Scotch
16	30·100	30·059	34·5	33·1	31·9	38·7	·191	·186	96	90	Calm 0	Calm 0	10	2	—	⁂ *ga.* and before. [⁂ *gp.*
17	29·966	29·843	31·6	41·2	31·2	41·2	·173	·355	97	98	Calm 0	Calm 0	10	10	·040	⁂ all day.
18	·693	·767	42·0	39·4	39·2	44·2	·241	·333	91	97	SSW 2	ESE 2	10	10	·660	⁂°
19	·486	·456	43·3	39·2	37·1	44·0	·254	·206	91	86	SSW 2	SSW 2	10	2	·380	
20	·453	·334	40·1	43·6	35·4	49·6	·227	·248	92	87	SSW 3	SW 4	10	1	·490	⁂°*ga.* ⁄ afternoon and evening.
21	·724	·427	39·4	47·2	37·2	47·7	·212	·301	88	93	WSW 4	SW 3	·4	10	1·700	⁄ in past night ⁄ *gp.*
22	·330	·561	45·7	41·1	38·0	51·7	·266	·211	87	82	SW 4	SW 6	10	9	·140	⁄ in past night and during day. ▲ ⁄ *gp.* ⌇ *rop.* ≷ in evening.
23	·769	·925	42·2	43·4	36·8	43·4	·223	·231	84	82	WSW 5	WSW 5	10	5	·300	▲ *ga.* ● and ▲ showers during
24	29·839	29·925	45·7	41·0	39·0	47·7	·272	·221	89	86	SW 6	WSW 6	10	9	·550	⁄ in past night. [day. ⁄ *gp.*
25	30·169	30·364	40·6	42·9	38·9	43·0	·219	·254	87	92	Wb.S 4	Wb.S 3	3	10	·010	
26	·379	·373	45·1	44·0	41·7	46·2	·286	·270	95	94	Wb.S 2	Wb.S 2	10	9	·010	
27	·397	·372	41·9	42·0	39·4	44·8	·257	·231	97	87	SSW 1	SW 2	10	8	·030	
28	·458	·365	40·3	44·4	40·4	44·4	·239	·278	96	95	Calm 0	SW 2	10	10	·380	⁂°*ga.* Scotch ⁂ during day.
29	·286	·263	44·0	44·8	43·7	45·0	·284	·271	98	92	WSW 3	WSW 3	10	10	·100	Scotch ⁂° during day.
30	30·194	30·138	44·4	42·7	42·0	45·0	·269	·238	92	86	WSW 3	SW 3	10	10	·070	
31	29·962	29·739	40·3	45·5	40·0	47·2	·284	·298	86	92	SW 3	S W 4	10	10	·380	Scotch ⁂ *ira.* ⁄ *gp.*
Means	30·071	30·063	37·2	37·9	33·9	40·7	·201	·206	88·0	89·7		2·1	8·6	7·7	2·660	

STRATHFIELD TURGISS.

Height above Mean Sea Level 196 feet. Long. 1° 0′ W. Lat. 51° 20′ N.

DECEMBER, 1875.

Day.	Barometer.		Temperature.			Vapour Tension.	Humidity.		Wind and Force.		Amount of Cloud.			Rain.	Remarks.
	9 a.m.	9 p.m.	9 a.m.	9 p.m.	Min.	Max.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 a.m.	
	ins.	ins.	°	°	°	°	in.	%	%					ins.	
1	29·908	29·900	29·5	32·0	27·8	34·4	·148	92	85	E 1	10	NE 1-2	10	—	/ p.
2	·739	·770	32·0	30·7	29·0	36·0	·181	100	78	N 1	3	N 1	10	·819	* qp.
3	·849	·865	30·8	27·7	26·2	32·2	·152	90	88	N 1	10	Calm 0	10	—	* a and p.
4	·830	29·983	31·0	24·5	19·2	35·1	·153	88	80	Calm 0	10	N 1	10	—	* / p.
5	29·983	30·088	28·4	22·0	19·0	31·3	·140	91	83	N 1	0	N 1	10	·050	/ p.
6	30·112	·909	31·4	28·5	21·4	32·2	·158	89	90	N 1	10	N 1-3	10	·100	* qa. / p.
7	·422	·431	29·9	31·0	28·3	34·3	·144	87	82	NE 1	10	N 1	4	—	
8	·451	·439	33·8	28·0	27·9	36·6	·149	77	86	N 0-1	10	N 1	10	—	
9	·412	·444	32·5	30·0	25·3	37·0	·148	82	86	NW 1	10	NW 1	6	—	
10	·365	·261	34·9	36·4	29·0	41·4	·153	75	90	W 1	3	W 1	10	—	
11	·177	·168	37·9	40·5	35·3	42·4	·206	90	90	NW 0-1	10	NW 1	10	—	
12	·150	·196	40·8	40·1	29·3	45·3	·231	92	85	W 1	10	NW 1	10	—	
13	·232	·236	33·0	27·7	20·6	44·4	·171	91	88	SW 1	8	N 1	10	—	
14	·191	·135	33·6	35·3	26·4	38·1	·137	71	90	SE 0-1	10	SE 1	10	—	▒ a.
15	·168	·173	35·8	38·4	33·4	40·5	·193	93	93	SE 1	10	SE 1	10	—	
16	·150	30·098	35·5	37·0	35·3	39·6	·208	100	96	SE 0-1	10	E 1	10	—	▒ qa.
17	30·012	29·949	38·0	41·5	35·4	48·0	·220	96	98	SE 1	3	SE 1-0	10	—	
18	29·865	·812	41·0	43·4	40·0	46·5	·239	94	96	Calm 0	10	S 1	10	·033	
19	·659	·685	45·4	39·6	38·6	48·0	·304	100	97	S 1	10	S 1	5	·039	
20	·748	·608	46·4	49·0	37·6	51·5	·359	83	96	SW 1-2	10	SW 1	0	·094	/
21	·931	·759	42·7	48·0	40·6	53·9	·238	86	95	W 1	0	SW 2-3	10	·307	/ p.
22	29·658	29·903	52·6	43·9	40·0	52·6	·353	89	92	SW 2-3	10	SW 1-2	0	·033	/ a.
23	30·113	30·289	41·9	42·0	41·8	49·1	·225	85	85	SW 1	0	W 1	0	·020	
24	·355	·144	45·7	48·0	37·9	51·1	·271	89	100	W 1-2	2	SW 1	10	·017	
25	·393	·490	40·0	41·8	37·8	48·0	·226	92	100	SW 0-1	0	Calm 0	10	—	
26	·484	·457	—	43·5	40·6	47·4	—	94	94	NW 0-1	10	Calm 0	10	·010	▒ qa and before. ▒ p.
27	·474	·487	43·0	42·8	41·3	45·1	·264	95	93	SW 0-1	10	Calm 0	10	—	
28	·533	·519	42·3	42·6	41·2	45·3	·252	94	94	SW 0-1	10	W 0-1	10	—	
29	·450	·396	42·0	43·0	41·0	46·7	·247	93	94	SW 0-1	10	Calm 0	10	—	
30	·337	·305	42·5	42·6	40·0	47·3	·250	92	94	W 0-1	10	SW 0-1	10	—	
31	30·184	30·063	41·3	43·4	40·8	47·7	·242	94	96	S 1	10	S 1-2	10	—	
Means	30·137	30·140	*37·9	37·6	33·8	42·9	*·209	*89·7	90·8		0·9	0·9	7·7	8·5	1·052

* 30 days.

METEOROLOGY OF ENGLAND,

DURING THE QUARTER ENDING MARCH 31, 1876.

Remarks on the Weather during the Quarter ending March 31st, 1876.

By James Glaisher, Esq., F.R.S., &c.

Till January 4th, the weather was warm, the average excess of mean daily temperature was 6° nearly, and on the 3rd day was as large as 13½°. On the 5th, the wind changed from the W. to the S.E. and the first long cold period set in, and continued till the 16th, the wind being, for the most part, from the N. and N.E., on the 8th day the departure of mean temperature below its average was 13½°, and the average defect of temperature for these 12 days was 6¾°. On the 17th the wind was S.W and a warm period set in and continued till February 3rd, the wind being, for the most part, from the S.S.W. and S.E., the average daily excess of temperature was 3¾°; the second cold period began on February 4th and continued till the 13th; the wind was chiefly from the N., on the 11th the mean temperature of the day was nearly 13½° below its average; and for the 10 days ending the 13th was on the average 6¾° in defect.

From the 14th of February to the 8th of March, the temperature was mostly in excess of the average, and the direction of the wind was generally from the S.W on the 17th and 18th of February the mean temperatures were about 12° in excess of their averages, and on March 3rd, the excess was more than 10°, and for the 24 days ending March 8th, the average daily excess was 6½°. On the 9th day of March the third long cold period began, and continued to the 27th, the direction of the wind was mostly from the W.N.W. and N.E., and the average daily deficiency of temperature for the 19 days was 3¾°. On the 19th of March the deficiency of temperature exceeded 10°; from March 28th to the end of the quarter the weather was warm, and the mean daily temperatures of the four days were 5½° in excess of their averages.

Maximum and Minimum Temperatures of the Air, on certain days in January, February, and March 1876.

Names of Stations.	January.				February.				March.			
	3rd.		8th.		11th.		18th.		3rd.		19th.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
	°	°	°	°	°	°	°	°	°	°	°	°
Guernsey	52·5	42·5	56·5	28·5	57·5	34·5	54·0	47·5	53·5	41·0	41·0	30·0
Helston	55·0	46·0	55·0	32·0	45·0	41·0	54·0	45·0	53·0	41·0	45·0	36·0
Truro	56·0	45·0	52·0	28·0	41·0	36·0	51·0	49·0	54·0	47·0	47·0	30·0
Plymouth	52·5	37·5	50·0	28·0	40·0	32·0	52·0	47·5	52·5	44·5	47·5	28·5
Eastbourne	50·6	37·9	52·3	23·8	40·7	30·0	54·1	44·0	52·2	47·1	39·1	25·7
Osborne	51·6	34·7	28·4	24·8	42·9	25·4	52·9	44·2	50·4	41·0	40·8	27·2
Bournemouth	52·1	32·5	29·5	26·1	39·0	30·6	47·8	44·5	50·8	43·5	41·0	30·0
Hastings	51·3	46·5	26·9	20·9	39·8	25·6	49·0	43·2	48·8	43·5	37·5	23·5
Taunton	53·0	31·0	33·0	27·0	36·5	29·0	56·0	50·0	54·6	43·0	44·8	22·0
Salisbury	55·5	30·0	29·0	24·5	41·5	21·0	54·0	44·0	50·0	39·5	39·0	25·0
Barnstaple	51·5	40·0	38·0	29·0	44·0	33·0	56·5	51·0	53·0	46·0	45·0	31·0
Caterham	49·0	37·0	29·0	22·0	35·0	19·0	50·0	43·0	48·0	32·0	43·0	24·0
Ramsgate	53·0	42·5	28·8	24·5	34·9	24·1	53·9	45·7	51·8	42·9	41·7	27·8
Strathfield Turgiss	53·4	40·0	29·0	16·3	34·4	18·2	54·3	44·0	54·8	40·5	37·6	32·2
Weybridge Heath	53·0	48·0	27·5	17·5	28·8	19·0	50·8	46·3	51·5	44·0	33·8	24·5
East Tilbury	55·5	40·0	45·4	17·3	43·0	23·0	54·5	38·7	56·5	40·0	42·2	27·2
Marlborough	53·3	43·7	28·2	22·6	38·1	26·5	52·9	46·3	56·4	41·7	36·6	25·3
Bristol	52·2	30·3	30·0	27·2	38·7	24·7	53·8	49·4	55·5	44·0	38·1	23·6
Blackheath	54·6	46·0	27·3	21·9	30·1	22·9	60·1	45·9	56·8	42·4	36·3	25·8
Royal Observatory	53·9	45·0	27·6	17·4	28·9	21·0	56·0	46·4	56·2	46·0	37·0	25·5
Beckenham	54·0	39·0	28·0	10·0	31·6	19·0	58·4	46·0	57·8	43·1	37·6	25·2
Streatley	54·5	39·8	29·0	20·9	39·2	20·0	55·2	44·9	54·0	41·5	44·2	27·4
Camden Square	54·5	32·4	28·4	26·4	28·8	23·4	58·2	47·0	57·1	34·9	36·1	27·0
Chiswick	55·5	39·0	35·5	24·5	38·0	21·7	56·2	47·5	54·2	43·0	43·0	26·0
Leicester	53·0	43·4	30·8	24·0	31·1	22·8	55·8	48·0	55·9	43·5	37·2	24·4
Oxford	55·5	40·0	29·5	23·2	29·0	21·8	55·7	44·1	58·0	41·6	37·5	25·7
Gloucester	53·0	25·0	31·0	27·0	38·5	20·5	60·2	47·0	58·0	42·7	38·0	25·1
Royston	51·7	28·3	—	—	26·4	24·2	55·5	45·0	54·5	39·0	40·7	23·1
Cardington	50·0	27·0	35·4	26·6	35·6	23·6	54·6	45·6	52·4	40·0	41·0	26·0
Lampeter	50·5	35·0	37·5	29·0	40·0	—	51·0	41·5	52·0	42·0	41·0	29·5
Cambridge	55·6	37·0	30·0	27·2	36·4	26·4	58·3	48·0	58·8	43·2	38·4	25·6
Norwich	51·2	40·0	29·0	25·0	31·8	24·0	58·0	48·0	56·5	43·0	39·0	26·0
Birmingham	53·3	27·2	31·0	27·0	36·8	21·5	54·9	48·0	56·3	39·8	34·0	26·6
Wolverhampton	51·7	32·0	29·8	27·1	34·4	22·1	53·0	46·8	55·0	38·1	33·8	24·6
Wisbech	51·5	31·8	30·6	28·0	36·5	23·2	57·1	46·8	57·0	42·3	39·1	26·0
Llandudno	53·6	37·1	33·0	31·3	37·7	25·0	56·5	46·5	56·6	44·4	39·0	26·3
Nottingham	50·5	27·4	34·6	29·3	34·3	19·5	58·4	43·2	52·5	42·5	41·1	24·0
Holkham	48·6	27·5	37·2	23·7	35·7	22·2	54·5	40·2	51·8	37·6	38·2	21·5
Sheffield	55·0	32·5	35·0	29·5	40·7	24·5	54·0	42·0	57·0	41·5	35·0	24·5
Calcethorpe	50·4	35·9	31·0	17·2	35·2	23·7	55·3	46·6	54·2	38·3	38·2	23·7
Liverpool	50·0	31·5	36·5	30·6	33·9	22·0	53·3	42·0	52·2	42·9	38·8	31·9
Manchester	51·7	35·8	37·0	32·0	—	—	—	—	—	—	—	—
Eccles	52·2	34·8	32·7	29·0	32·7	16·8	55·3	42·2	56·5	39·8	36·4	24·9
Moorside	52·6	32·0	30·6	29·2	36·0	21·0	54·2	42·5	55·7	40·6	35·0	25·0
Bermerside	51·8	35·8	30·2	28·3	34·5	21·7	54·0	44·5	55·3	39·1	35·0	24·0
Hull	48·0	36·0	32·0	31·0	38·0	30·0	55·0	46·0	56·0	40·0	41·0	25·0
Stonyhurst	51·2	40·4	32·0	17·2	32·0	23·0	53·0	40·7	55·1	41·5	36·0	24·4
Bradford	46·8	51·2	36·2	30·8	35·2	26·0	53·1	42·9	52·4	41·4	—	—
Leeds	53·0	32·0	33·0	31·0	37·0	30·0	57·0	44·0	57·0	39·0	—	27·0
Cockermouth	51·4	43·6	29·7	16·4	34·4	20·0	50·0	43·0	50·4	42·2	38·2	26·1
Allenheads	46·0	27·0	32·0	29·0	32·0	18·0	46·5	35·7	49·0	34·0	—	—
Silloth	51·0	41·4	37·4	31·9	42·0	20·2	51·1	41·6	52·2	41·1	40·7	27·2
Sunderland	48·0	35·0	36·0	33·0	37·0	29·0	54·0	42·0	50·0	39·0	38·0	27·0
Carlisle	51·8	40·9	35·3	15·8	37·4	22·9	54·0	40·0	53·3	40·8	37·7	22·0
Bywell	47·0	35·0	37·0	34·0	42·0	28·0	54·0	43·0	58·0	42·0	40·0	27·0
Newcastle-on-Tyne	—	—	38·0	20·0	35·0	22·0	51·0	34·0	54·0	34·0	—	—
North Shields	50·0	42·0	39·2	34·5	36·8	27·3	52·0	39·4	55·0	38·3	35·0	25·8
Milltown (Ireland)	54·0	38·0	35·0	33·0	39·0	24·0	51·0	42·0	53·0	40·0	40·0	29·0

On looking over this Table, it will be seen how very great the changes of temperature have been all over the country, in each month of the quarter.

On every day in the three cold periods, *snow* fell in some part of the country, and during the warm *periods, rain fell* very frequently. From February 13th to March 15th rain or snow fell

on 25 days, or on more than 25 days, at every one of the different stations. The weather during the quarter has been remarkable for an excess of atmospheric pressure in January and great deficiency from February 5th to the end of the quarter, for the amounts of snow, and for the great alternations of temperature in each month. These great changes are exhibited in the preceding Table which gives the maximum and minimum temperatures of the warmest and coldest days in each month.

The readings of the barometer at 160 feet above the level of the sea, in the neighbourhood of London, were above their respective averages throughout the month of January, excepting on two days, viz., 20th and 21st which were 0·08 in. and 0·26 in. below. The greatest departure in excess during the month was 0·72 in. on the 15th. The mean reading for the month was 30·095 ins., being 0·355 in. above its average. During the first four days of February, the barometer readings were a little in excess of the average, but from the 5th day of February to the 1st of April, the readings were all below their average values (excepting on two days), viz., February 24th and March 20th, which were above their averages, but only to the small amounts of 0·08 in. and 0·05 in.

During this remarkable and long continued period of 57 days of low readings, violent gales of wind, and showers of hail, rain, and snow were experienced. The following are some of the greatest departures in defect of the average during this period:—February 18th and 19th 0·58 in. and 0·56 in.; March 8th, 9th, 10th, 11th, 12th, 15th, and 28th; or 0·66 in., 1·31 in., 1·36 in., 0·95 in., 1·30 in., 0·74 in., and 0·72 in., respectively on these days. The readings were the lowest from March 8th to the 12th, and for these five days, the mean defect below the average was no less than 1·12 ins., and for the whole period of 57 days, the mean defect was 0·35 in.

The mean reading for the month of February was 29·628 ins., being 0·171 in. below the average.

Back to the year 1841 there are only five instances of the mean reading of the barometer being as low in the month of February, as in the present year, viz.:—

1843, 29·473 ins. 1844, 29·498 ins. 1848, 29·517 ins.
1855, 29·593 ins. 1866, 29.529 ins.

The mean reading of the barometer, for the month of March, was 29·391 ins., being 0·359 in. below the average; and in the preceding 35 years there is no value so low as that in the present year, the nearest approach being in the year 1862, when it was 29·498 ins.

At Greenwich *the mean temperature* of January was 1°·6 lower than that of December; that of February was 4°·0 higher than that of January; and that of March was the same as that of February. (From the preceding 35 years' observations the mean temperature of January below that of December is 1°·5; that of February above that of January is 0°·6; and that of March above that of February is 2°·5.)

The mean temperature of the air for January below that of December; South of latitude 51¼° was 1°·4; from 51½° to 53½° was 2°·2; from 53½° to 53¾° was 1°·4; and from 53¾° to 55° was 0°·3 only. That of February above that of January, South of 50¾° was 2°·8; from 50¾° to 52½° was 4°·0; from 52¼° to 53¼° was 2°·0; and from 53¾ to 55° was 0°·1 below. That of March below that of February was 1°·2 at places South of 50¾°; and from 50¾° to 55° was 0°·3, below the general decrease of mean temperature from February to March all over the country was 0°·4.

The mean temperature of the air for January was 37°·1, being 0°·6 above the average of the preceding 105 years, and 1°·5 below the average of the preceding 35 years; it was 4°·6 and 6°·3 below the corresponding values in 1874 and 1875.

The mean temperature of the air for February was 41°·1, being 2°·5 and 1°·9 higher than the average of the preceding 105 years and 35 years respectively; it was 2°·4 and 6°·1 higher than the corresponding values in 1874 and 1875.

The mean temperature of the air for March was 41°·1, being the same as the average value for the preceding 105 years, and 0°·6 below the average of the preceding 35 years; it was 2°·6 lower than that of 1874, and 0°·9 higher than that of 1875.

The mean high day temperatures of the air were 0°·7 and 0°·8 below their respective averages in January and March; but 1°·3 above in February.

The mean low night temperatures of the air were 2°·7 and 0°·2 lower than their respective averages in January and March; but 2°·2 above in February.

The mean daily ranges of temperature were 0°·9 and 0°·6 smaller than their respective averages in February and March; but 2°·0 larger in January.

Therefore the days and nights of January and March were cold, but warm in February.

At Greenwich the increase of atmospheric pressure from December to January was 0·158 in., the decrease from January to February was 0·467 in., and the decrease from February to March was 0·237 in. Over the whole country the mean increase of pressure from December to January was 0·161 in.; the decrease from January to February was 0·475 in., being somewhat smaller at Southern stations, and somewhat larger at Northern stations; the mean decrease from February to March was 0·229 in., and was nearly the same at all stations.

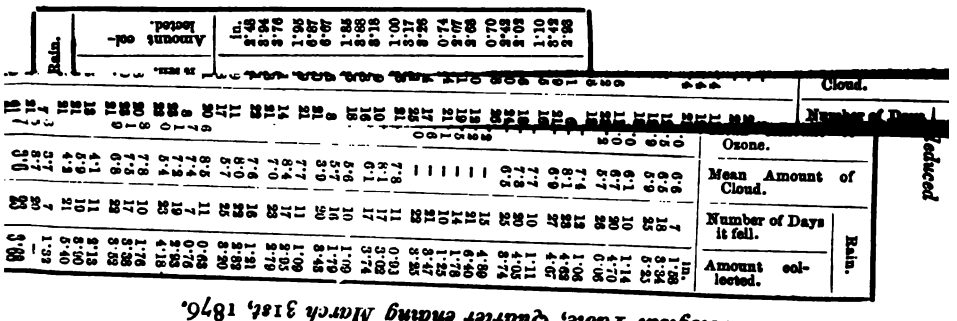
At Greenwich the fall of rain in January was 1·1 in. being 0·8 ins. below its average; in February it was 1·5 in. being equal to the average value; and in March the fall was 2·3 ins., being 0·7 in. above the average; the heaviest fall in one day was 0·68 in. on the 12th of March. The total fall in the quarter was 4·9 ins., being exactly equal to the average. Rain fell on 50 days, exceeding the average number in these 3 months by 20 days, the distribution of the rain over the quarter has been therefore very different from what is usual, and this seems to have been more or less the case all over the country.

Thunderstorms occurred, on 5 days in February; and on 9 days in March.

Thunder was heard, but lightning was not seen, on 2 days in February; and on 6 days in March.

Lightning was seen, but thunder was not heard, on 1 day in February; and on 4 days in March.

Solar halos were seen on 3 days in January; 11 days in February; and on 10 days in March.



affected with this sign are N.E., E. and S., in February to W., and in March to S. and W.

The — signs denote below averages; in January the largest number with this sign is S.W., in February is E., and in March is S.E.

1876. Months.	Temperature of Air. Mean.	Temperature of Air. Diff. from average of 105 years.	Temperature of Air. Diff. from average of 35 years.	Temperature of Evaporation. Mean.	Temperature of Evaporation. Diff. from average of 35 years.	Temperature of Dew Point. Mean.	Temperature of Dew Point. Diff. from average of 35 years.	Air—Daily Range. Mean.	Air—Daily Range. Diff. from average of 35 years.	Water of the Thames.	Elastic Force of Vapour. Mean.	Elastic Force of Vapour. Diff. from average of 35 years.	Weight of Vapour in a Cubic Foot of Air. Mean.	Weight of Vapour in a Cubic Foot of Air. Diff. from average of 35 years.
	°	°	°	°	°	°	°	°	°	°	in.	in.	grs.	gr.
Jan. -	37·1	+0·6	−1·5	35·5	−1·6	33·2	−1·9	11·6	+2·0	39·2	0·189	−0·012	2·2	−0·2
Feb. -	41·1	+2·5	+1·9	39·1	+1·7	36·5	+1·6	10·4	−0·9	41·3	0·216	+0·011	2·5	+0·1
Mar. -	41·1	0·0	−0·6	38·5	−0·8	35·1	−1·3	14·1	−0·6	42·6	0·204	−0·012	2·4	−0·1
Means -	39·8	+1·0	−0·1	37·7	−0·2	34·9	−0·5	12·0	+0·2	41·0	0·203	−0·004	2·4	−0·1

1876. Months.	Degree of Humidity. Mean.	Degree of Humidity. Diff. from average of 35 years.	Reading of Barometer. Mean.	Reading of Barometer. Diff. from average of 35 years.	Weight of a Cubic Foot of Air. Mean.	Weight of a Cubic Foot of Air. Diff. from average of 35 years.	Rain. Amount.	Rain. Diff. from average of 61 years.	Daily Horizontal movement of the Air.	Reading of Thermometer on Grass. Number of Nights it was At or below 30°.	Between 30° and 40°.	Above 40°.	Lowest Reading at Night.	Highest Reading at Night.
			in.	in.	grs.	grs.	in.	in.	Miles.				°	°
Jan. -	85	−3	30·095	+0·355	552	+9	1·1	−0·8	278	20	10	1	14·0	41·7
Feb. -	84	−1	29·628	−0·171	549	−4	1·5	0·0	375	13	10	6	17·0	44·8
Mar. -	80	−2	29·391	−0·359	544	−6	2·3	+0·7	429	11	18	2	18·3	42·7
Means -	83	−2	29·705	−0·058	552	0	Sum 4·9	Sum 0·0	Mean 361	Sum 44	Sum 38	Sum 9	Lowest 14·0	Highest 44·8

Note.—In reading this table it will be borne in mind that the minus sign (−) signifies *below* the average, and that the plus sign (+) signifies *above* the average.

Lunar halos were seen on 3 nights in January; 6 nights in February; and on 13 nights in March.

Auroræ boreales were seen on the 19th of February at Calcethorpe, Liverpool, and North Shields.

Snow fell on 15 days during January; 18 days during February; and on 19 days during March; thus making 52 during the quarter. The falls in January and February were pretty general all over the country, but in March the heaviest falls were in the Midland and Northern Counties. At some places in March snow fell consecutively from the 6th to the 22nd.

Hail fell at one or other station on 7 days in January; 17 days in February; and on 20 days in March.

Fog prevailed on 20 days in January; 11 days in February; and on 7 days in March.

Leaf buds first appeared on the Sycamore, on the 27th of February at Strathfield Turgiss.

Leaf buds first appeared on the Horsechestnut, on the 26th of February at Helston; on the 7th of March at Strathfield Turgiss; on the 12th at Caterham; on the 20th at Guernsey; and on the 27th at Weybridge.

Leaf buds first appeared on the Hawthorn, on the 15th of February at Weybridge.

Field Elm in leaf, on the 8th of March at Helston.

Hawthorn in leaf, on the 9th of March at Oxford; on the 10th at Helston; on the 20th at Guernsey; and on the 24th at Weybridge.

Pear in blossom, on the 22nd of February at Helston; and on the 21st of March at Llandudno.

Peach in blossom, on the 23rd of February at Helston; on the 14th of March at Oxford; and on 26th at Wisbech.

Plum in blossom, on the 17th of March at Strathfield Turgiss; on the 24th at Llandudno; and on the 28th at Oxford.

Wryneck arrived, on the 31st of March at Guernsey.

Woodcock departed, on the 25th of February from Strathfield Turgiss.

HAWES.

Height above Mean Sea Level 800 feet. Long. 2° 11′ W. Lat. 54° 18′ N.

NOVEMBER, 1875.

Day.	Barometer.		Air Temperature.				Tension of Vapour.		Relative Humidity.		Wind, Direction and Force.		Cloud Amount.		Rain.	Remarks
	9 a.m.	9 p.m.	9 a.m.	9 p.m.	Min.	Max.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	
	ins.	ins.	°	°	°	°	in	in.	%	%					ins.	
1	29·949	29·919	38·0	36·9	35·6	40·3	·217	·186	95	86	ESE 1	ESE 1	10	10	·010	
2	·867	·789	40·0	40·8	36·0	42·7	·208	·355	85	100	ESE 1	NE 2	10	10	·590	
3	·733	·714	49·5	53·4	40·5	53·6	·344	·364	98	89	ESE 1	SSW 1	10	10	·080	≡ *gz* and during day.
4	·710	·859	50·7	42·3	41·9	53·9	·331	·266	89	99	WSW 2	SSW 1	8	0	·010	☾ [2] *gp.*
5	·684	·468	48·7	48·4	41·6	54·3	·318	·288	93	85	WSW 1	Wb.S 4	10	0	·540	≡ ° *gz.*
6	·692	·139	47·9	46·2	45·5	50·9	·334	·377	100	90	Calm 0	Wb.N 1	10	10	·510	≡
7	·268	·272	39·0	33·3	33·3	46·8	·199	·179	84	95	Wb.S 3	Wb.S 2	0	8	·010	⌋ ° *gp.*
8	·373	·495	32·8	32·5	31·3	40·9	·149	·158	80	87	Wb.N 1	W 2	0	1	·010	✳ ° during past night.
9	29·434	·330	36·8	33·5	24·0	35·4	·117	·183	81	96	Wb.N 1	Calm 0	1	10	·190	✳ ° in past night. ≡ *gp.*
10	28·904	·117	36·1	35·1	32·5	37·0	·208	·188	98	92	NNE 2	E 2	10	10	·080	✳ ° on hills, *gp.*
11	29·188	·392	36·8	40·5	34·9	44·6	·184	·226	85	90	NW 2	W 2	9	9	·080	
12	·786	·998	36·0	29·0	28·8	46·0	·174	·137	82	86	Wb.S 1	Wb.N 1	0	0	—	⌋ *gz.* ⌊ ⊔ (large) *gp.*
13	29·811	·344	35·0	40·0	27·0	40·0	·193	·245	95	99	E 1	E 3	10	10	2·470	≡
14	28·945	29·851	44·4	35·5	35·1	45·0	·280	·182	96	88	NNE 2	W 4	10	2	·700	/
15	30·144	30·205	37·7	33·1	31·3	45·2	·193	·186	85	99	NW 1	Calm 0	1	0	·020	⌋ *gz.* ≡ ⌊ ° ⊔ ° (large) *gp.*
16	29·979	29·762	43·0	40·0	31·9	46·0	·226	·284	82	93	SW 1	SW 2	10	6	·330	≡ ° in aft. [≡ Midt.
17	·916	·696	45·7	52·0	43·8	52·0	·266	·361	87	93	SW 2	SW 3	10	10	·710	/ *gp.*
18	·903	·863	51·5	50·9	50·0	52·5	·346	·336	91	91	SW 5	SW 4	10	10	·750	/ in past night. / *rop.*
19	29·466	29·993	47·7	39·2	39·1	52·0	·292	·196	89	82	SW 6	N 4	10	1	·020	/ in past night.
20	30·155	30·170	31·8	31·4	30·1	39·7	·148	·152	82	87	NNW 3	NNW 3	1	0	·020	
21	·153	·209	35·6	35·9	29·9	39·1	·177	·186	85	88	NNE 2	NE 1	3	9	·080	[during day. ✳ ° ● ° showers
22	·362	·360	35·4	35·6	33·9	37·2	·170	·177	82	85	NE 1	NE 1	10	10	·080	✳ ° (small) in past night. ● ° ✳ °*gp.*
23	·374	·348	36·5	36·1	33·3	39·1	·184	·196	86	93	NE 1	E 1	10	10	·100	✳ ● in past night.
24	·365	·271	34·7	33·1	33·0	36·9	·169	·163	83	87	ESE 2	E 1	10	10	·030	✳ ° showers during day.
25	·179	·161	32·8	27·5	26·0	34·0	·159	·131	86	88	NE 1	NE 1	9	5	·060	✳ ° in past night. ✳ *gz.* ✳ (large)
26	·060	·110	31·1	32·7	27·2	33·5	·164	·170	95	92	NNE 1	E 1	7	9	·310	in showers during day.
27	·201	·295	33·3	34·9	30·2	34·9	·184	·181	97	89	E 2	Eb.N 1	9	10	·030	✳ °(small) in past night. ✳ °during day.
28	·338	·377	33·7	32·0	32·0	35·0	·144	·141	74	77	Eb.N 2	Eb.N 1	10	4	·010	✳ in past night & during day. ≡ with
29	·205	·162	32·4	32·3	30·0	33·8	·170	·154	93	84	Eb.N 1	ENE 1	10	9	·060	✳ ° (small) in evening. [thaw in aft. and evening.
30	30·114	30·072	30·9	32·2	29·0	32·7	·168	·170	91	94	ENE 1	Eb.N 3	9	10	·020	≡ ° on hills, *gz.* ✳ 9-32. ✳ ✳ [showers during day.
Means	29·820	29·854	38·5	37·7	34·0	42·8	·214	·211	88·3	90·1	1·7	1·9	7·6	6·8	7·810	

Meteorological Table, Quarter ending March 31st, 1876.

Names of Stations and Observers.	Height of Station above Sea Level.	Year 1876. Months.	Pressure of Atmosphere in Month. Mean.	Lowest.	Highest.	Temperature of Air in Month. Mean. Range.	Mean. Of all Highest.	Of all Lowest.	Daily Range.	Mean Temperature. Air.	Dew Point.	Vapour. Elastic Force.	Mean. In a Cubic foot of Air.	Short of Saturation.	Mean Degree of Humidity. Sat^{n}. = 100.	Mean Weight of a cubic foot of Air.	Mean Reading of Thermometer. Maximum in Rays of Sun.	Minimum on Grass.	Rainfall. Mean Strength.	Wind. N.	Wind. E Prop.
	feet.		in.	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°			
RAMSGATE (St. Augustine's Monastery). Rev. T. Hugh Quelch, O.S.B.	109	Jan.	30·168	23·0	53·5	30·5	41·4	33·2	8·2	37·5	33·5	·192	2·2	0·4	85	563	63·4	39·3	1·8	7	3
		Feb.	30·069	27·8	54·1	33·7	49·4	36·7	8·7	41·1	36·8	·218	2·5	0·5	85	550	78·0	33·6	2·0	4	4
		Mar.	29·453	17·21	55·3	38·2	47·6	30·6	11·0	41·9	36·1	·213	2·6	0·4	81	544	90·0	34·0	1·8	6	6
STRATFIELD TURGISS (Hants). Rev. C. H. Griffith, M.A., F.M.S.	195	Jan.	30·052	16·3	53·9	38·6	42·7	30·6	12·1	37·0	31·0	·174	2·0	0·6	81	561	61·7	29·1	0·6	8	6
		Feb.	29·963	17·8	54·1	36·3	46·7	33·7	11·1	41·0	36·3	·211	2·7	0·3	90	548	78·8	30·3	0·7	6	5
		Mar.	29·366	21·0	63·9	42·9	47·7	34·3	13·4	40·5	35·3	·206	2·3	0·4	84	544	94·4	30·6	0·8	7	5
WEYBRIDGE HEATH (Surrey). William E. Harrison, Esq., F.M.S.	170	Jan.	30·114	17·3	53·8	36·5	42·0	32·0	10·0	36·7	31·4	·199	2·3	0·2	92	563	54·0	30·2	0·8	7	5
		Feb.	29·979	14·5	53·0	38·5	46·4	35·3	11·1	40·7	36·5	·215	2·5	0·3	84	550	64·7	32·8	1·0	5	5
		Mar.	29·436	14·05	64·0	49·5	58·3	34·7	14·2	40·8	36·3	·233	2·7	0·3	91	545	70·3	33·0	1·2	5	2
EAST TILBURY Vicarage (Essex). Rev. R. Tyas, M.A., LL.D.	25	Jan.	30·237	17·0	52·2	35·2	42·5	29·0	13·5	38·4	35·4	·210	2·5	0·2	93	563	47·1	27·5	0·4	8	6
		Feb.	29·750	21·0	54·0	33·0	46·0	33·2	12·8	42·4	37·1	·251	2·7	0·3	86	550	67·4	32·9	1·0	4	4
		Mar.	29·524	21·5	61·2	39·7	49·9	32·3	17·6	42·7	38·6	·254	2·7	0·3	86	545	84·2	33·8	1·4	4	2
MARLBOROUGH, The Green (Wilts). Rev. Thomas A. Preston, M.A., F.M.S.	474	Jan.	29·762	19·9	53·4	33·5	42·0	31·1	10·9	36·5	31·8	·202	2·2	0·2	94	560	57·5	29·0	0·3	6	6
		Feb.	29·661	20·3	53·7	33·4	46·0	33·3	12·7	40·6	37·4	·224	2·6	0·4	89	543	76·2	34·2	0·5	8	5
		Mar.	29·050	20·5	59·5	39·0	48·0	33·8	12·8	40·6	35·7	·200	2·4	0·5	86	539	90·5	31·8	0·6	8	6
BLACKHEATH (Kent). James Glaisher, Esq., F.R.S.	150	Jan.	29·996	21·2	53·8	32·6	42·8	30·8	10·8	37·4	34·1	·196	2·3	0·4	88	561	53·8	29·7	1·4	7	4
		Feb.	29·927	20·7	54·1	33·4	47·2	32·1	11·4	41·5	37·2	·229	2·6	0·5	88	548	69·1	33·4	2·1	6	4
		Mar.	29·391	23·2	65·0	41·8	49·2	31·6	14·0	41·2	35·6	·207	2·4	0·6	80	544	75·8	33·2	1·7	7	4
BECKENHAM, Kent. C. O. F. Cator, Esq., M.A., F.M.S.	174	Jan.	30·058	19·5	51·0	31·5	42·8	29·0	13·8	36·3	31·6	·193	2·2	0·4	86	562	—	—	—	—	—
		Feb.	29·910	18·1	52·3	34·2	47·0	33·0	12·0	40·7	36·9	·218	2·5	0·4	86	549	—	—	—	—	—
		Mar.	29·373	23·8	61·4	37·6	50·0	32·8	16·2	40·9	37·5	·224	2·6	0·4	88	544	—	—	—	—	—
STREATLEY VICARAGE (Berks). Rev. J. Slatter, M.A., F.R.A.S., F.M.S.	150	Jan.	30·125	20·9	53·0	32·1	43·4	32·1	11·3	37·6	34·6	·202	2·3	0·3	89	561	—	—	—	—	—
		Feb.	29·941	18·8	53·4	34·6	47·0	33·1	10·9	41·0	36·8	·218	2·5	0·5	84	548	—	—	—	0·8	7
		Mar.	29·413	23·8	62·0	38·2	48·0	34·8	13·2	41·3	35·4	·213	2·6	0·5	83	544	—	—	—	1·6	8
CAMDEN SQUARE (London). G. J. Symons, Esq., F.M.S.	123	Jan.	30·135	18·9	53·9	35·0	42·5	31·5	11·0	37·4	34·0	·200	2·3	0·4	90	562	48·2	29·6	—	—	—
		Feb.	29·954	19·0	53·6	34·6	46·7	33·6	10·1	41·7	37·4	·221	2·6	0·4	86	548	62·3	33·9	—	—	—
		Mar.	29·428	19·8	60·9	41·1	48·9	33·9	13·7	41·8	36·6	·216	2·5	0·6	83	544	85·4	31·2	—	—	—
CHISWICK (Middlesex). J. K. L. M. Farquhar, Esq.	35	Jan.	30·240	16·7	53·0	36·3	43·0	31·7	11·3	37·0	34·3	·196	2·3	0·3	88	564	—	29·6	0·7	7	5
		Feb.	29·774	20·6	53·2	32·6	47·0	36·1	11·0	41·9	37·6	·233	2·6	0·5	86	550	—	32·2	0·8	6	4
		Mar.	29·228	20·7	59·5	38·8	49·0	34·3	15·1	41·3	36·3	·213	2·5	0·5	83	546	—	32·1	1·1	8	3
LEICESTER (Town Museum). W. J. Harrison, Esq., F.G.S.	216	Jan.	30·046	15·0	53·8	38·8	41·1	31·6	9·5	36·4	33·5	·192	2·2	0·3	90	560	53·5	29·7	0·8	7	4
		Feb.	29·924	20·3	53·4	33·1	45·5	33·9	9·6	40·4	36·1	·213	2·5	0·4	85	547	78·9	32·9	0·9	5	5
		Mar.	29·460	20·7	61·1	40·4	49·3	32·3	12·3	40·0	35·6	·194	2·3	0·6	78	543	89·1	32·0	1·0	5	3
OXFORD Observatory. Rev. R. Main, M.A., F.R.S., F.R.A.S.	210	Jan.	30·038	20·7	52·6	31·9	42·0	30·3	11·7	37·4	34·6	·200	2·3	0·3	90	560	59·6	31·5	0·6	7	6
		Feb.	29·937	20·9	52·1	31·2	46·5	35·4	11·1	41·7	37·7	·237	2·6	0·4	87	546	76·4	34·7	1·1	6	4
		Mar.	29·387	21·1	59·0	37·9	49·0	33·3	15·7	40·9	35·4	·207	2·4	0·7	82	543	88·9	33·2	1·2	4	4
GLOUCESTER. E. Toller, Esq., M.D.	109	Jan.	30·083	22·2	52·9	30·7	43·4	30·2	13·2	37·4	33·8	·210	2·3	0·2	94	563	50·9	33·8	0·4	6	6
		Feb.	29·954	20·5	53·6	33·1	47·8	32·5	11·3	41·7	37·6	·251	2·7	0·1	86	549	69·1	34·9	1·9	7	6
		Mar.	29·501	22·0	59·0	37·0	48·8	34·0	14·8	40·7	37·0	·220	2·6	0·4	87	545	81·0	34·7	1·1	9	6
ROYSTON (Hertfordshire). Hale Wortham, Esq., F.R.A.S., F.M.S.	269	Jan.	29·985	18·4	54·2	35·8	42·2	30·3	12·2	36·5	34·3	·196	2·3	0·2	92	560	—	—	—	—	—
		Feb.	29·909	18·4	54·2	35·8	45·8	34·8	12·4	41·0	36·9	·219	2·5	0·5	85	545	—	—	—	4	6
		Mar.	29·291	19·1	59·5	40·4	47·2	33·0	14·2	40·3	35·1	·204	2·4	0·5	84	543	—	—	—	6	5
CARDINGTON (near Bedford). Mr. Maclaren, Assistant to S. C. Whitbread, Esq., F.R.S.	105	Jan.	30·156	15·0	53·4	38·4	41·0	29·5	11·5	33·4	30·2	·192	2·2	0·2	92	563	44·2	26·0	1·3	7	7
		Feb.	29·958	21·0	53·4	32·4	46·6	35·8	10·8	40·6	37·5	·227	2·6	0·3	89	549	68·5	30·0	1·9	6	6
		Mar.	29·455	22·0	57·0	35·0	48·2	33·8	14·4	40·2	35·9	·212	2·4	0·4	88	546	89·1	29·1	2·2	5	5

Meteorological Table, Quarter ending March 31st, 1876.

7

Rain. Amount collected.	Number of Days it fell.	Amount collected.
in.		in.
1·43	11	2·43
2·94	15	3·94
2·76	15	3·76
1·93	16	3·93
0·97	9	2·07
1·95	16	3·95
2·88	15	3·88
2·18	15	3·18
1·00	10	3·00
3·17	15	3·17
3·26	17	3·26
0·74	9	2·74
2·07	13	3·07
3·06	15	3·06
0·70	9	2·70
2·43	11	3·43
2·93	16	3·93
1·10	10	3·10
2·42	13	3·42
2·98	16	3·98

HAWES.

Height above Mean Sea Level 800 feet. Long. 2° 11′ W. Lat. 54° 18′ N.

DECEMBER, 1875.

Day.	Barometer.		Air Temperature.				Tension of Vapour.		Relative Humidity.		Wind, Direction and Force.		Cloud Amount.		Rain.	Remarks.
	9 a.m.	9 p.m.	9 a.m.	9 p.m.	Min.	Max.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	
	ins.	ins.	°	°	°	°	in.	in.	%	%					ins.	
1	30·110	30·104	31·9	32·2	31·2	32·7	·159	·160	88	88	ENE 3	NE 1	10	10	·010	[✳ °gp.
2	29·984	29·965	32·5	32·0	29·8	33·0	·148	·172	81	95	Nb.E 2	NE 1	10	10	·950	✳ gz. ✳ ° ≋ on hills, and ✢ ° during day.
3	·927	29·843	32·6	31·0	27·1	33·7	·163	·146	89	84	NNE 1	WSW 1	10	3	·010	[during day. ✳ gp.
4	29·935	30·132	32·0	29·5	27·9	33·9	·167	·124	92	76	NE 1	NE 1	9	4	·060	✳ °gz and before. ✳ showers in day.
5	30·192	·239	29·5	25·2	21·5	30·2	·125	·088	85	65	Eb.N 1	ENE 2	10	2	·310	✳ in night and gz. ✢ °gp.
6	·348	·489	29·2	29·3	23·3	30·1	·136	·127	84	78	ENE 1	ENE 2	10	10	·010	✳ in night and at gz. ≋ on hills.
7	·525	·503	31·0	31·3	28·0	32·4	·107	·146	62	84	NNE 1	NNW 1	9	10	—	[✢ °gz. ✳ °gp.
8	·526	·477	29·7	31·9	29·0	32·4	·137	·175	77	97	NW 1	NW 1	10	9	·010	≋ on hills during day.
9	·475	·442	32·0	37·0	27·0	37·5	·158	·187	87	85	WSW 1	Wb.N 1	1	8	·010	✳ ° in past night, and during day.
10	·330	·180	37·5	40·0	32·0	40·0	·189	·211	85	86	Wb.N 1	WNW 2	10	10	·130	
11	·119	·101	40·9	41·1	39·4	42·6	·238	·211	94	83	WNW 2	Wb.N 1	10	8	·010	
12	·083	·121	41·2	40·2	40·0	43·0	·218	·228	85	92	W 2	Calm 0	10	10	—	
13	·154	·189	41·0	38·9	38·1	42·0	·235	·184	92	79	Wb.S 1	Wb.N 1	10	10	·010	
14	·150	·129	33·7	27·2	27·1	41·2	·160	·122	82	84	SW 1	Calm 0	0	0	—	≋ in valley. └ gp.
15	·152	·126	20·3	33·1	18·6	33·1	·085	·182	78	97	Calm 0	SW 1	0	10	—	└ gz, and during day. Scotch
16	30·100	30·059	34·5	33·1	31·9	38·7	·191	·186	96	99	Calm 0	Calm 0	10	2	—	≋ gz. and before. [≋ gp.
17	29·966	29·843	31·6	41·2	31·2	41·2	·173	·255	97	98	Calm 0	Calm 0	10	10	·040	≋ all day.
18	·693	·767	42·0	39·4	39·2	44·2	·241	·333	91	97	SSW 2	ESE 2	10	10	·660	≋ °
19	·486	·456	43·3	39·2	37·1	44·0	·254	·206	91	86	SSW 2	SSW 2	10	2	·380	
20	·453	·334	40·1	43·6	35·4	49·6	·227	·248	92	87	SSW 3	SW 4	10	1	·490	≋ °gz. ✓ afternoon and evening.
21	·724	·427	39·4	47·2	37·2	47·7	·213	·301	88	93	WSW 4	SW 3	·4	10	1·700	✓ in past night ✓ gp.
22	·320	·561	45·7	41·1	38·0	51·7	·266	·211	87	82	SW 4	SW 6	10	9	·140	✓ in past night and during day.
23	·760	·925	42·2	43·4	36·8	43·4	·233	·231	84	82	WSW 5	WSW 5	10	5	·300	▲ ≺ in evening. ✓ gp. ⟀ rop.
24	29·829	29·925	45·7	41·0	39·0	47·7	·272	·221	89	86	SW 6	WSW 6	10	9	·550	✓ ▲ gz. ● and ▲ showers during
25	30·169	30·364	40·6	42·9	38·9	43·0	·219	·264	87	92	Wb.S 4	Wb.S 3	3	10	·010	✓ in past night. [day. ✓ gp.
26	·379	·373	45·1	44·0	41·7	46·2	·286	·270	95	94	Wb.S 2	Wb.S 2	10	9	·010	
27	·397	·372	41·9	42·0	39·4	44·8	·257	·231	97	87	SSW 1	SW 2	10	8	·030	
28	·458	·365	40·3	44·4	40·4	44·4	·239	·278	96	95	Calm 0	SW 2	10	10	·380	≋ °gz. Scotch ≋ during day.
29	·286	·263	44·0	44·8	43·7	45·0	·284	·271	98	92	WSW 3	WSW 3	10	10	·100	Scotch ≋ ° during day.
30	30·194	30·138	44·4	42·7	42·0	45·0	·269	·238	92	86	WSW 3	SW 3	10	10	·070	
31	29·962	29·739	40·3	45·5	40·0	47·2	·214	·298	86	93	SW 3	S W 4	10	10	·280	Scotch ≋ rid. ✓ gp.
Means	30·071	30·063	37·2	37·9	33·0	40·7	·201	·206	88·0	87·7	2·0	2·1	8·6	7·7	2·660	

Names of Stations and Observers.	Height of Station above Sea Level.	Year 1876.	Pressure of Atmosphere in Month.		Temperature of Air in Month.						Mean Temperature.		Vapour.			Mean Degree of Humidity, Sat. = 100.	Mean Weight of a cubic foot of Air.	Mean Reading of Thermometer.		Wind.					Mean Amount of Ozone.	Mean Amount of Cloud.	Rain.	
								Mean						In a cubic foot of Air.								Relative Proportion of						
		Months.	Mean.	Range.	Highest.	Lowest.	Range.	Of all Highest.	Of all Lowest.	Daily Range.	Air.	Dew Point.	Elastic Force.	Mean.	Short of Saturation.			Maximum in Rays of Sun.	Minimum on Grass.	Estimated Strength.	N.	E.	S.	W.			Number of Days it fell.	Amount collected.
	feet.		in.	in.	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°								in.
COCKERMOUTH (Cumberland), H. Dodgson, Esq., M.D., F.R.A.S., F.M.S.	146	Jan.	29·964	0·960	51·7	16·8	34·9	44·9	36·1	8·8	40·3	37·3	·222	2·6	0·3	89	556	51·3	23·8	0·5	4	7	11	9	2·5	7·0	18	2·48
		Feb.	29·517	1·160	51·1	20·4	30·7	44·6	36·1	8·5	39·9	36·0	·212	2·4	0·4	86	548	67·4	27·0	0·4	4	8	10	7	2·9	6·3	13	3·94
		Mar.	29·306	1·724	50·6	21·2	29·4	44·8	34·3	10·5	39·3	34·9	·204	2·4	0·4	85	544	76·7	24·5	0·7	6	5	8	12	3·9	6·3	19	3·76
ALLENHEADS (Northumberland), Mr. T. Kidd, Assistant to W. B. Beaumont, Esq., M.P.	1360	Jan.	28·715	0·996	50·0	13·5	36·5	40·7	30·2	10·5	35·5	–	–	–	–	–	–	61·3	–	0·8	7	5	12	7	–	5·8	15	1·93
		Feb.	28·211	1·272	49·0	18·0	31·0	40·7	29·3	11·4	34·4	–	–	–	–	–	–	63·8	–	1·0	5	6	8	10	–	6·9	26	6·87
		Mar.	27·957	1·606	49·0	16·0	33·0	40·7	28·3	12·4	33·2	–	–	–	–	–	–	71·7	–	1·2	6	6	7	12	–	6·6	25	6·07
SILLOTH RECTORY (Cumberland), Rev. Francis Redford., M.A., F.R.A.S., F.M.S.	28	Jan.	30·148	1·074	53·0	18·3	34·7	44·4	34·6	9·8	39·3	36·3	·214	2·5	0·3	90	560	59·8	30·9	1·4	8	5	8	10	0·5	5·8	12	1·85
		Feb.	29·637	1·204	54·9	20·2	34·7	46·5	34·6	11·9	39·7	35·9	·212	2·6	0·4	88	550	71·2	30·9	1·2	5	5	6	10	0·9	5·0	18	3·66
		Mar.	29·406	1·760	52·3	25·7	26·6	46·8	34·0	12·8	39·4	35·3	·206	2·4	0·7	78	546	75·7	30·2	1·8	8	6	4	13	9·8	6·0	17	3·18
CARLISLE (Cumberland), Isaac Cartmell, Esq., F.M.S.	114	Jan.	30·056	1·029	53·6	15·8	37·8	44·8	33·7	11·1	35·8	36·0	·213	2·5	0·4	91	559	55·7	29·0	1·2	4	5	13	9	5·7	7·0	12	1·00
		Feb.	29·562	1·262	54·0	21·9	33·1	45·5	32·8	12·5	38·7	34·7	·202	2·3	0·4	86	550	67·6	28·3	1·7	4	7	8	10	7·5	6·8	18	3·17
		Mar.	29·327	1·738	53·3	20·5	34·8	45·7	32·2	13·5	38·2	34·8	·202	2·4	0·3	89	546	74·9	28·2	2·7	6	5	6	14	6·2	6·7	17	3·26
BYWELL (Northumberland), Mr. John Dawson, Assistant to W. B. Beaumont, Esq., M.P.	87	Jan.	30·046	1·056	56·0	22·0	34·0	45·9	35·0	10·9	39·8	34·1	·197	2·4	0·5	81	558	52·3	29·4	1·2	3	9	8	11	–	6·2	15	0·74
		Feb.	29·539	1·212	56·0	25·0	31·0	46·1	35·3	10·8	39·7	34·2	·198	2·3	0·5	81	548	55·2	29·7	1·4	5	7	6	11	–	6·1	27	2·07
		Mar.	29·287	1·735	58·0	27·0	31·0	47·7	34·9	12·8	39·7	33·5	·192	2·2	0·6	80	544	60·1	29·4	1·7	8	8	5	10	–	5·3	27	2·68
NORTH SHIELDS (Northumberland), Robert Spence, Esq.	124	Jan.	30·121	1·153	52·2	25·0	27·2	43·2	34·2	9·0	38·4	33·7	·194	2·3	0·5	84	561	–	30·6	1·3	7	4	8	12	–	6·2	14	0·70
		Feb.	29·006	1·177	52·4	25·0	27·4	43·6	34·4	9·2	38·5	34·9	·203	2·3	0·4	87	551	–	31·1	1·6	6	7	5	11	–	7·1	25	2·42
		Mar.	29·343	1·675	55·0	25·8	29·2	44·1	33·7	10·4	38·1	33·4	·191	2·2	0·5	82	546	–	29·9	2·4	8	5	5	13	–	6·7	23	2·02
MILLTOWN Banbridge, (Ireland), John P. Smyth, Esq., Jun., M.A., M.I.C.E.I., F.G.S.	200	Jan.	29·816	0·978	54·0	20·0	34·0	45·4	34·6	10·8	40·0	36·8	·218	2·5	0·4	89	553	64·7	30·4	1·5	6	2	17	6	–	5·2	15	1·10
		Feb.	29·349	1·268	53·0	20·0	33·0	45·6	34·1	11·5	39·4	35·2	·214	2·5	0·4	89	545	81·9	30·3	2·0	5	8	11	5	–	4·9	22	3·42
		Mar.	29·156	1·630	55·0	26·0	29·0	45·4	33·0	12·4	38·5	34·9	·203	2·3	0·4	87	543	97·5	29·0	2·1	7	5	11	8	–	6·5	25	2·93

NOTE.—*The Barometer Reading*, Leeds, 1st January, 4h. p.m., 29·064 in., has been altered to 30·064 in.
" " Taunton, 29th February, 9h. a.m., 30·772 in., " 29·772 in.
" " Holkham, 11th March, 8h. p.m., 29·978 in., " 28·978 in.
" " Bournemouth, 21st " 9h. a.m., 30·96 in., " 29·96 in.

Second Rain-gauges are placed—

			January.		February.		March.		Total during the Quarter.	
At Eastbourne,	at the height of 160 feet *above the sea*,	the amount collected was	1·36 inches.	–	3·20 inches.	–	3·01 inches.	–	7·57 inches.	
At Beckenham,	at the height of 50 feet *above the ground*,	the amount collected was	0·68 "	–	1·72 "	–	2·50 "	–	4·85 "	
" Strathfield Turgiss,	"	38 feet "	0·48 "	–	1·28 "	–	2·24 "	–	4·00 "	
" Oxford,	"	22 feet "	1·45 "	–	2·62 "	–	3·10 "	–	7·17 "	
" Cardington,	"	36 feet "	1·30 "	–	1·75 "	–	1·80 "	–	4·85 "	
" Wisbech,	"	8 feet "	2·07 "	–	2·24 "	–	2·69 "	–	7·00 "	
" Nottingham,	"	39 feet "	2·05 "	–	1·78 "	–	2·44 "	–	6·27 "	
" Holkham,	"	4 feet "	1·74 "	–	2·92 "	–	2·39 "	–	7·05 "	
" Eccles (Manchester),	"	34 feet "	1·41 "	–	3·23 "	–	2·93 "	–	7·57 "	
" Milltown (Ireland),	"	40 feet "	0·85 "	–	— "	–	2·78 "	–	— "	

NAMES OF STATIONS.	Mean Pressure of dry Air reduced to the level of the Sea.	Highest Reading of the Thermometer.	Lowest Reading of the Thermometer.	Range of Temperature in the Quarter.	Mean of all Highest.	Mean of all Lowest.	Mean Monthly Range of Temperature.	Mean Daily Range of Temperature.	Mean Temperature of the Air.	Mean Temperature of the Dew Point.	Mean Elastic Force of Vapour.	Mean Weight of Vapour in a cubic foot of Air.	Mean additional Weight required for saturation.	Mean degree of Humidity.	Mean Weight of a cubic foot of Air.	Mean Reading of Maximum in Rays of Sun.	Mean Reading of Minimum on Grass.	Wind. Mean Estimated Strength.	Wind. Relative Proportion of N.	Wind. Relative Proportion of E.	Wind. Relative Proportion of S.	Wind. Relative Proportion of W.	Mean Amount of Ozone.	Mean Amount of Cloud.	Rain. Number of Days on which it fell.	Rain. Amount collected.
	in.	°	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°									in.
Guernsey	29·681	53·5	27·5	26·0	46·9	39·1	23·2	7·9	42·5	39·5	·244	2·8	0·4	90	548	—	—	1·7	6	6	9	9	3·8	6·3	20	10·17
Helston	29·646	57·0	26·0	31·0	50·5	40·0	27·0	10·5	44·9	40·7	·254	2·9	0·5	85	547	58·5	36·6	2·4	7	5	7	10	5·4	6·2	25	11·99
Truro	29·677	57·0	22·0	35·0	48·9	38·9	30·7	10·0	43·4	39·2	·241	2·8	0·5	85	550	—	—	2·7	7	6	7	10	—	7·5	22	10·75
Plymouth	29·737	56·5	24·0	32·5	47·2	37·4	27·5	10·5	42·6	40·2	·250	2·9	0·3	91	552	—	36·1	2·5	7	9	7	7	—	7·2	25	8·70
Osborne	29·660	61·1	22·8	38·3	46·7	34·9	33·2	11·8	40·3	38·0	·230	2·6	0·3	92	551	67·3	33·4	0·5	6	6	10	9	—	7·3	45	7·69
Bournemouth	29·709	58·3	22·5	35·8	45·9	36·3	27·2	9·6	40·9	36·4	·215	2·5	0·5	84	551	—	—	—	7	6	6	12	—	5·1	46	6·21
Brighton	29·668	55·7	22·6	33·1	43·9	35·4	28·0	8·5	39·6	36·6	·217	2·5	0·3	89	551	—	31·8	1·1	8	4	9	10	—	7·2	51	6·93
Hastings	29·691	57·5	30·9	26·6	43·8	35·7	29·1	8·1	39·6	36·2	·213	2·5	0·4	88	552	—	32·7	2·1	8	5	9	9	—	7·1	63	7·23
Taunton	29·667	57·7	20·0	37·7	47·4	35·1	35·3	12·3	40·9	38·2	·231	2·7	0·4	87	552	52·4	32·9	0·2	8	4	7	12	3·6	6·7	49	7·82
Salisbury	29·683	62·0	16·5	45·5	47·0	32·4	29·5	14·6	39·7	36·7	·218	2·5	0·3	89	551	71·9	29·9	1·6	7	8	6	8	4·3	7·4	49	8·06
Barnstaple	29·641	57·0	21·5	35·5	48·3	38·6	30·0	9·7	43·0	39·7	·245	2·8	0·4	88	550	—	—	1·3	6	6	9	10	—	4·7	51	11·43
Caterham	29·720	—	14·0	—	44·4	31·8	44·7	12·5	38·1	35·5	·208	2·4	0·4	90	544	—	—	1·7	6	4	7	13	2·2	—	50	—
Ramsgate	29·686	57·8	23·5	34·3	44·8	35·5	29·8	9·3	40·2	35·5	·208	2·4	0·4	84	552	77·1	32·7	1·7	6	6	10	9	—	7·1	41	5·38
Strathfield Turgiss	29·694	60·0	16·3	43·7	45·7	33·5	29·6	12·2	39·5	34·9	·204	2·3	0·4	84	551	78·3	29·7	0·7	7	6	7	10	2·9	6·9	43	6·30
Weybridge Heath	29·709	64·0	17·5	46·5	45·8	34·0	38·8	11·8	39·4	36·4	·215	2·5	0·3	89	553	66·0	32·9	1·0	6	6	10	8	2·3	6·7	45	5·77
East Tilbury	29·655	65·0	17·3	47·7	—	33·0	—	—	41·2	37·8	·228	2·6	0·4	88	553	66·2	31·5	0·9	5	7	10	9	—	7·9	43	4·95
Marlborough Green	29·659	59·6	19·9	39·7	44·9	33·7	34·7	11·2	38·9	36·0	·212	2·5	0·4	90	546	74·7	31·5	0·5	7	5	7	12	—	7·4	51	9·83
Blackheath	29·671	65·9	21·2	44·7	46·3	34·2	38·3	12·3	40·0	35·6	·209	2·4	0·5	85	551	66·9	31·8	1·7	6	6	9	9	—	7·0	47	5·09
Beckenham	29·665	64·4	10·0	54·4	46·6	32·6	42·3	14·0	39·3	36·0	·212	2·4	0·4	88	552	—	—	—	5	6	9	10	—	6·6	52	6·22
Streatley Vicarage	29·688	58·7	18·8	39·9	46·3	34·3	35·0	12·0	40·3	36·0	·212	2·5	0·4	85	551	—	—	1·3	7	6	8	9	—	6·7	54	7·15
Camden Square	29·667	63·3	18·9	44·4	46·0	34·4	36·1	11·6	40·3	36·2	·214	2·5	0·5	86	551	65·3	31·6	—	8	4	7	11	—	6·7	51	5·87
Chiswick	29·665	59·7	16·7	43·0	46·8	34·1	36·7	12·7	40·2	36·1	·212	2·5	0·4	86	553	77·3	30·0	0·9	4	5	8	13	—	7·8	42	5·15
Leicester	29·650	60·7	15·0	45·7	44·4	33·2	37·8	10·5	38·9	34·5	·200	2·3	0·4	84	550	74·5	27·8	0·9	5	5	9	11	—	7·2	62	7·70
Oxford	29·661	60·9	20·1	40·8	44·8	35·2	34·1	9·6	40·0	35·9	·211	2·4	0·5	86	550	76·0	33·1	1·0	6	5	9	11	2·4	8·2	52	7·73
Gloucester	29·697	60·1	20·5	39·6	46·7	35·6	35·4	13·1	39·9	37·8	·228	2·7	0·2	93	553	67·5	32·6	0·9	8	6	6	10	1·7	7·6	48	6·78
Royston	29·681	59·1	18·4	40·7	46·4	32·7	35·4	13·7	39·3	35·4	·207	2·4	0·4	87	549	—	—	—	5	4	11	10	—	6·7	47	6·41
Carlington	29·654	62·0	15·0	47·0	45·5	32·9	37·3	12·4	38·8	35·7	·210	2·4	0·3	90	553	56·6	28·4	2·3	6	5	7	12	—	6·7	50	6·22
Lampeter	29·691	56·3	10·6	46·5	46·0	33·1	40·3	12·9	39·5	35·7	·210	2·4	0·4	87	547	68·8	—	—	6	7	8	9	—	—	51	11·11
Cambridge	29·629	64·1	18·0	46·1	46·2	34·3	37·4	11·9	39·8	36·4	·215	2·5	0·4	88	553	81·1	30·2	2·1	6	4	9	11	—	6·7	51	6·25
Norwich	29·624	59·0	23·0	36·0	44·1	34·5	32·9	9·6	38·9	37·4	·224	2·6	0·2	95	551	—	—	—	5	5	11	9	—	—	49	6·32
Wisbech	29·631	63·5	21·0	42·5	45·3	34·1	35·7	11·3	39·0	35·6	·209	2·4	0·3	88	554	78·1	30·3	0·7	5	5	10	10	3·6	6·9	52	7·28
Llandudno	29·602	57·0	22·2	34·8	47·5	37·1	31·7	10·4	42·0	36·1	·214	2·5	0·6	80	549	—	—	1·0	3	6	11	11	—	8·2	45	7·16
Nottingham	29·634	58·4	17·8	40·6	45·9	32·9	36·4	11·0	38·3	34·5	·201	2·3	0·4	87	552	63·1	30·3	0·5	6	6	9	9	2·9	7·1	68	7·33
Holkham	29·638	58·0	17·3	40·7	44·8	29·9	37·5	14·9	38·2	33·5	·192	2·2	0·5	83	554	76·0	27·6	2·1	5	5	13	8	—	6·8	32	7·46
Calcethorpe	29·683	59·8	17·1	42·7	42·7	34·1	36·2	10·6	37·0	34·1	·195	2·3	0·5	89	549	77·9	29·0	1·3	5	5	9	11	8·1	6·5	63	6·38
Liverpool	29·615	56·2	21·8	34·4	45·1	35·4	31·6	9·7	39·8	34·3	·199	2·3	0·6	81	549	—	—	1·5	5	7	10	8	—	6·7	44	5·52
Eccles	29·625	56·5	14·4	42·1	45·4	32·9	36·5	12·5	39·3	34·8	·202	2·4	0·5	84	551	59·1	26·1	0·5	5	6	9	9	2·6	7·5	50	9·31
Moorside, Halifax	29·632	58·2	17·0	41·2	43·9	33·8	34·4	10·1	38·2	34·1	·197	2·3	0·4	85	546	60·2	30·3	1·2	6	6	13	9	2·0	7·7	57	9·00
Bermerside, "	29·637	59·0	15·0	44·0	42·3	32·8	35·7	9·5	37·8	33·7	·194	2·2	0·4	86	545	68·7	—	0·8	4	8	8	11	—	7·3	48	10·38
Hull	29·610	57·0	24·0	33·0	43·9	34·2	30·3	9·7	39·5	35·0	·204	2·4	0·5	85	554	58·3	31·7	—	—	—	—	—	2·6	—	53	7·32
Stonyhurst	29·602	55·1	17·3	37·8	43·5	33·9	32·1	9·6	38·7	35·3	·204	2·4	0·4	87	547	77·8	30·4	—	6	4	7	13	—	7·8	64	15·79
Bradford	29·600	55·6	23·0	32·6	43·7	33·9	29·6	9·8	39·0	34·0	·196	2·3	0·5	83	546	53·5	—	0·8	6	6	5	13	—	7·9	55	8·43
Leeds	29·591	60·0	27·0	33·0	45·7	34·9	30·0	10·8	40·2	35·2	·205	2·4	0·5	83	550	59·7	—	1·4	6	6	6	12	—	6·7	49	6·74
Cockermouth	29·546	51·7	16·8	34·9	44·8	35·5	31·7	9·3	39·8	35·1	·213	2·5	0·4	87	549	65·1	28·8	0·5	5	7	10	9	3·1	6·5	45	10·18
Allenheads	—	50·0	13·5	36·5	40·7	29·3	33·5	11·4	34·4	—	—	—	—	—	—	63·6	—	1·0	6	6	9	10	—	6·4	66	15·49
Silloth	29·550	54·9	18·3	36·3	45·9	34·4	32·0	11·5	39·5	35·8	·211	2·5	0·5	85	552	68·9	30·7	1·5	7	6	6	11	2·7	5·6	47	8·31
Carlisle	29·572	55·3	15·8	39·5	45·3	32·9	35·2	12·4	38·6	35·2	·206	2·4	0·4	89	552	66·1	28·5	1·9	5	6	9	11	6·5	6·8	47	7·46
Bywell	29·525	58·0	22·0	36·0	46·6	35·1	32·0	11·5	39·7	33·9	·193	2·3	0·5	81	550	55·9	29·5	1·4	5	8	6	11	—	5·9	69	9·68
North Shields	—	55·0	25·0	30·0	43·6	34·1	27·9	9·5	38·3	34·0	·196	2·3	0·5	84	555	—	30·5	1·8	7	5	6	12	—	6·7	52	5·74
Milltown (Ireland)	—	55·0	20·0	35·0	45·5	35·9	32·0	11·6	39·3	36·0	·212	2·4	0·4	88	547	81·4	29·9	1·9	6	5	13	6	—	5·5	63	7·43

The highest temperatures of the air were at Blackheath, 65°·9 and at East Tilbury 65°.
The lowest temperatures of the air were at Beckenham and Lampeter, both 10° and at Allenheads, 13°·5.
The greatest daily ranges of the temperatures of the air were at Holkham, 14°·9 and at Salisbury, 14°·6.
The least daily ranges of the temperatures of the air were at Guernsey, 7°·9 and at Hastings, 8°·1.
The greatest numbers of rainy days were at Bywell, 69 Nottingham, 68 and at Allenheads, 66.
The least numbers of rainy days were at Ramsgate, 41 and at Chiswick, 42.
The heaviest falls of rain were at Allenheads, 15·49 inches and at Stonyhurst, 13·79 inches.
The least falls of rain were at East Tilbury, 4·95 inches; and at North Shields, 5·14 inches.

Quarterly Meteorological Table for different Parallels of Latitude.

PARALLELS OF LATITUDE, &c.	Mean Pressure of dry Air reduced to the level of the Sea.	Mean of all Highest Readings of the Thermometer.	Mean of all Lowest Readings of the Thermometer.	Mean Range of Temperature in the Quarter.	Mean of all Highest.	Mean of all Lowest.	Mean Monthly Range of Temperature.	Mean Daily Range of Temperature.	Mean Temperature of the Air.	Mean Temperature of the Dew Point.	Mean Elastic Force of Vapour.	Mean Weight of Vapour in a cubic foot of Air.	Mean additional Weight required for saturation.	Mean degree of Humidity.	Mean Weight of a cubic foot of Air.	Mean Reading of Maximum in Rays of Sun.	Mean Reading of Minimum on Grass.	Wind. Mean Estimated Strength.	Wind. Relative Proportion of N.	Wind. Relative Proportion of E.	Wind. Relative Proportion of S.	Wind. Relative Proportion of W.	Mean Amount of Ozone.	Mean Amount of Cloud.	Rain. Mean Number of Days it fell.	Rain. Mean Amount collected.
	in.	°	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°									in.
Guernsey	29·681	53·5	27·5	26·0	46·9	39·1	23·2	7·9	42·5	39·5	·241	2·8	0·4	90	548	—	—	1·7	5	6	9	9	3·8	6·3	20	10·17
Between 50° and 51°	29·671	57·6	23·0	34·6	46·8	36·9	29·0	9·9	41·6	38·2	·231	2·7	0·4	88	551	62·9	34·1	1·9	7	6	8	9	—	6·9	54	8·44
Between 51° and 52°	29·673	61·6	18·1	43·5	46·3	34·1	37·0	12·2	40·0	36·4	·216	2·4	0·4	87	551	70·3	31·4	1·9	6	6	8	10	2·8	6·8	49	7·73
the 52° and 53°	29·643	59·7	18·1	41·6	45·5	33·5	36·1	12·0	39·3	35·6	·209	2·4	0·4	87	552	70·5	29·4	1·5	5	5	8	10	3·1	6·7	51	7·73
latitudes 53° and 54°	29·616	57·5	19·6	37·9	44·0	33·8	32·9	10·2	38·8	34·5	·199	2·3	0·5	85	549	63·3	29·5	1·1	5	6	8	11	3·7	7·1	54	8·77
54° and 55°	29·548	54·0	17·3	36·7	44·7	33·4	32·9	11·3	38·4	35·2	·207	2·4	0·5	86	551	64·2	28·9	1·3	6	7	8	10	6·4	6·2	55	9·71
Mean for the Quarter, 50° to 55° Year 1873	29·650	63·3	20·5	42·8	45·7	34·7	31·1	11·0	39·8	35·9	·216	2·5	0·4	86	551	63·4	29·6	1·1	7	7	8	8	4·0	7·0	47	8·01
" 1874	29·812	61·3	20·1	41·2	48·2	35·9	32·0	12·3	41·9	37·8	·228	2·6	0·4	86	551	68·6	30·6	1·2	6	4	8	13	4·1	6·3	44	6·11
" 1875	29·809	57·7	17·3	40·4	45·4	35·1	31·7	10·3	39·8	36·4	·217	2·5	0·4	87	553	62·7	31·1	1·4	7	8	7	8	3·9	7·4	46	6·71
" 1876	29·631	58·1	19·2	38·9	45·5	34·5	33·6	11·2	39·6	36·0	·212	2·5	0·4	87	551	66·3	30·7	1·4	6	6	8	10	4·2	6·7	53	8·14

METEOROLOGY OF ENGLAND,

DURING THE QUARTER ENDING JUNE 30, 1876.

Remarks on the Weather during the Quarter ending June 30th, 1876.

By James Glaisher, Esq., F.R.S., *&c.*

Till April 9th, the weather was warm, and the average daily excess of the mean temperatures of these 9 days above their averages was 5½°. On the 10th of April, a very severe cold period set in and snow fell generally over the country north of latitude 51°; on the 11th, it fell more generally and extended to stations on the south coast; on the 12th, it fell still more generally, and there were falls of snow in Cornwall and Devonshire, and at Guernsey. In all the Northern Districts it fell in great quantities, in Scotland telegraphic communications were interrupted, and on the east coast, there was a very severe storm and gale of wind. At Leicester snow fell very heavily and in the midst of the snowstorm there were both thunder and lightning. London was visited by a succession of snowstorms, and in the afternoon there were vivid flashes of lightning and loud thunder. On the 13th, the weather was very severe, there was a bitterly cold wind, accompanied by constant storms of sleet and hail, and this unusually severe weather was experienced in all directions, a great quantity of snow fell; and all traffic between London and the North was greatly delayed, in some places the depth of the snow was from 16 inches to 24 inches.

On the 14th of April, the severest snowstorm of the whole winter was experienced. A great number of telegraphic posts were thrown down, and telegraphic communication was stopped in many localities, traffic generally was impeded and in some places stopped altogether; some snow drifts were of great depths, and snow fell everywhere. Garden trees and shrubs were broken down by the weight of the accumulated snow. On the 11th day the deficiency of mean temperature was 6½°; on the 12th was 11½°; on the 13th was 12°; and on the 14th was 9°. The highest and lowest temperatures during these days are shown in the following Table:—

Table of Maximum and Minimum Temperatures of the Air, on the 11th, 12th, 13th, and 14th of April 1876.

Names of Stations.	April.							
	11th.		12th.		13th.		14th.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
	°	°	°	°	°	°	°	°
Guernsey	48·5	43·5	45·5	33·0	44·0	33·5	48·0	34·0
Helston	50·0	30·0	49·0	34·0	46·0	33·0	49·0	34·0
Truro	50·0	39·0	48·0	35·0	44·0	35·0	49·0	34·0
Plymouth	52·5	37·5	53·0	33·0	50·0	35·0	45·0	33·0
Eastbourne	50·5	35·8	45·7	30·0	43·2	32·2	52·1	31·8
Osborne	51·2	35·0	44·3	30·9	40·7	30·1	49·5	31·2
Bournemouth	47·8	34·0	39·9	38·1	46·0	34·0	50·3	34·1
Hastings	48·2	34·0	44·2	29·5	40·3	29·4	45·2	32·3
Taunton	54·9	33·3	—	27·1	55·0	31·5	44·0	33·0
Salisbury	48·0	31·0	48·0	28·0	42·0	30·0	45·0	30·0
Barnstaple	54·0	37·5	47·0	34·0	45·5	36·0	45·0	35·5
Caterham	—	30·0	—	28·0	—	27·0	—	30·0
Ramsgate	48·8	34·5	45·0	29·5	41·0	29·9	45·7	33·7
Strathfield Turgiss	49·0	30·3	46·2	30·1	37·3	31·7	45·8	31·3
Weybridge Heath	50·0	30·0	45·5	27·8	38·5	28·0	46·0	31·5
East Tilbury	57·8	28·2	47·0	37·0	45·3	31·5	47·0	28·5
Marlborough	45·9	30·0	45·9	28·7	37·0	32·0	42·8	31·0
Bristol	46·8	31·7	49·6	30·9	44·4	33·3	42·3	32·2
Beckenham	49·5	31·1	46·0	27·1	40·1	27·2	48·0	30·8
Blackheath	51·9	31·8	46·1	29·9	40·3	30·1	44·3	32·0
Royal Observatory	50·3	32·0	46·1	29·2	44·1	29·9	47·0	31·8
Streatley	57·8	33·5	47·0	32·2	46·9	34·0	45·0	32·1
Chiswick	58·0	42·0	49·0	30·0	46·0	28·0	42·2	30·0
Camden Square	49·1	34·3	45·2	30·7	41·0	30·9	49·0	32·0
Oxford	47·0	30·5	42·8	32·2	37·0	31·1	44·9	31·2
Gloucester	51·5	31·0	49·5	29·0	54·0	31·0	46·0	33·0
Royston	52·3	31·6	49·3	29·0	46·0	28·0	43·0	30·4
Cardington	55·0	32·6	48·4	30·0	45·0	29·4	43·0	31·6
Lampeter	44·0	32·0	44·5	31·0	44·0	30·5	49·0	28·0
Cambridge	47·0	35·2	47·0	30·0	43·0	30·0	51·0	32·0
Norwich	43·0	33·2	45·0	30·0	39·5	29·2	48·0	33·0
Leicester	42·8	32·2	44·1	27·7	36·3	29·7	43·0	31·7
Birmingham	45·0	32·3	45·0	29·4	39·0	30·5	44·0	30·7
Wolverhampton	42·2	31·2	43·5	27·9	41·8	30·3	43·7	29·8
Wisbech	46·1	33·4	47·2	29·7	39·3	30·0	50·6	32·7
Nottingham	50·1	30·0	43·9	30·9	46·7	30·3	38·6	31·2
Holkham	54·4	29·5	43·5	27·2	44·5	24·3	39·5	28·0
Llandudno	47·0	32·9	46·0	33·0	41·9	31·9	47·0	36·0
Sheffield	45·0	31·0	45·0	28·7	40·0	30·0	44·0	31·9
Calcethorpe	42·7	31·2	42·2	23·2	35·3	23·7	42·3	33·2
Liverpool	45·0	32·3	42·1	31·6	42·2	31·5	40·5	33·0
Manchester	43·0	32·0	47·8	28·0	44·5	32·8	51·0	32·0
Eccles	42·5	30·5	44·8	27·1	43·4	29·8	49·5	30·1
Moorside	40·5	30·8	45·0	28·5	42·0	29·0	46·0	31·0
Bermerside	43·2	34·0	44·1	26·5	39·4	29·0	46·0	30·5
Hull	46·0	32·0	48·0	30·0	41·0	30·0	45·0	34·0
Stonyhurst	42·0	25·0	44·4	28·6	42·1	31·5	48·0	31·7
Bradford	46·4	30·6	41·6	30·4	44·6	30·2	40·8	31·8
Leeds	44·0	32·0	47·0	31·0	—	30·0	—	31·0
Cockermouth	43·3	31·5	44·1	31·9	44·0	24·6	48·4	28·9
Allenheads	37·3	25·5	39·0	20·0	42·0	19·0	42·0	23·0
Silloth	48·1	32·2	53·3	31·4	45·0	27·2	49·3	31·0
Sunderland	39·0	31·0	44·0	30·0	46·0	29·0	54·0	33·0
Carlisle	41·9	29·8	44·5	23·6	44·0	27·7	48·6	28·5
Bywell	44·0	33·0	46·0	31·0	45·0	26·0	46·0	31·0
Newcastle on Tyne	39·0	28·0	42·0	26·0	—	—	44·0	24·0
North Shields	39·8	30·0	41·3	30·4	40·6	27·5	44·2	32·2
Milltown (Ireland)	40·0	30·0	42·0	29·0	42·0	21·0	48·0	30·0

From this Table it will be seen that during the days the temperature at most places exceeded 40°, and at night was generally below 32°. On the 11th it was 25° at Stonyhurst, on the 12th it was 25°·2 at Calcethorpe, on the 13th it was 19° at Allenheads, and on the 14th it was 23° at Allenheads.

The severe cold period somewhat moderated on the 15th, but it continued till the 19th, and the average daily deficiency from April 10th to April 19th was 4¼°; on April 20th, a moderately warm period set in and continued for 10 days to the 29th, the average daily excess of temperature for these 10 days being a little less than 2°. On April 30th, a long cold period began, which continued with very few exceptions till the 18th of June; during the greater part of May there was a cold E. and N.E. wind, and no rain fell for 20 days; snow fell at different places on May 1st and 2nd, and as late as May 14th at Allenheads. The average daily deficiency of mean temperature for the 50 days ending June 18th, was 3½° nearly; and from the 19th of June to the end of the quarter the weather was generally warm, the average daily excess of mean temperature being 2¼°.

The readings of the barometer at 160 feet above the level of the sea, in the neighbourhood of London, were above their respective averages from the 2nd to the 8th of April, that for the 1st was 0·19 in. below; they were below their averages from the 9th to the 14th; above on the 15th and 16th; below from the 17th to the 22nd; a little above on the four following days; and again below from the 27th to the end of the month. The mean reading for the month was 29·680 ins., being 0·091 in. below its average. During the first 21 days of May, the readings of the barometer were all above their average values (the greatest departure in excess in this period was 0·53 inch on the 4th). From the 22nd to the 27th of May the readings were below their averages; and from the 28th to the end of the month they were above. The mean reading for the month was 29·956 ins., being 0·173 in. above its average. From the 1st to the 9th of June, the readings of the barometer were alternately above and below their respective averages, but only to small amounts; from the 10th to the 14th, they were above their averages; then below on the three following days, and constantly above and below for short intervals to the end of the month. The mean reading for the month was 29·816 ins., being 0·003 in. above the average.

At Greenwich *the mean temperature* for April was 6°·1 higher than that of March; that of May was 2°·2 higher than that of April; and that of June was 9°·1 higher than that of May. (From the preceding 35 years' observations the mean temperature of April above that of March is 5°·5; that of May above that of April is 5°·6; and that of June above that of May is 6°·1.)

The mean temperature of the air for April above that of March; South of latitude 51° was 4°·1; and North of 51° was 6°·0; that of May above that of April was 2°·3, South of 53½°; and 3·9 North of 53½°. That of June above that of May was 7°·2 South of 51°; between latitudes 51 to 52° was 9°·5; and North of 52° was 7·5.

The mean temperature of the air for April was 47°·2, being 1°·1 below the average of the preceding 105 years, and the same as the average of the preceding 35 years; it was 2°·8 below that of 1874, and 0°·9 below that of 1875.

The mean temperature of the air for May was 49°·4, being 3°·4 and 3°·1 below the averages of the preceding 35 years and 105 years respectively; it was 1°·1 and 5°·6 below the corresponding values in 1874 and 1875.

The mean temperature of the air for June was 58°·5, being 0°·4 below the average of the preceding 35 years, and 0°·3 above the average of the preceding 105 years; it was 0°·5 above that of 1874, and 0°·4 below that of 1875.

The mean temperature of the air for the quarter was 51°·7, being 1°·3 below the averages of the preceding 35 years, and 105 years.

The mean high day temperatures of the air were 0°·2 and 2°·9 below their respective averages in April and May; and 0°·1 above in June.

The mean low night temperatures of the air were 4°·8 and 1°·2 below their respective averages in May and June; and 0°·4 above in April.

Therefore the days and nights in April differed but little from their average value; in May both were cold; and in June the nights were cold.

The mean daily ranges of temperature were 1°·9 and 1°·3 greater than their respective averages in May and June; and 0°·5 less in April.

At Greenwich the increase of atmospheric pressure from March to April was 0·289 in., the increase from April to May was 0·276 in., and the decrease from May to June was 0·140 in. Over the whole country the mean increase from March to April was as follows:—Between latitude 50° and 51° was 0·250 in.; between 51° and 53¾° was 0·301 in.; and north of 53¾° was 0·367 in. The mean increase from April to May was as follows:—Between latitudes 50° and 53½° was 0·290 in.; and north of 53½° was 0·346 in. And the mean decrease from May to June, between latitudes 50° and 52½° was 0·142 in.; and north of 52½° was 0·203 in.

At Greenwich the fall of rain in April was 1·3 in., being 0·4in. below its average; in May was 1·1 in., being 1·0 in. below its average; and in June was 1·1 in., being 0·9 in. below its average. The total fall in the quarter was 3·5 in., being 2·3 in. below the average. The number of days on which rain fell in the quarter was 24.

Thunderstorms occurred, on 7 days in April; 2 days in May; and on 6 days in June.
Thunder was heard, on 8 days in April; 4 days in May; and on 9 days in June.
Lightning was seen, but thunder was not heard, on 6 days in April; and on 5 days in June.
Solar halos were seen on 9 days in April; 8 days in May; and on 13 days in June.
Lunar halos were seen on 5 nights in April; 3 nights in May; and on 1 night in June.
Auroræ boreales were seen on 4 days in April; and on 2 days in June.
Hail fell on 10 days in April; 5 days in May; and on 3 days in June. *Fog* on 28 days.

The average duration of the different directions of the wind referred to eight points of the *compass, and the duration of* each direction in each month in the quarter, were as follows:—

Direction of Wind.	April.			May.			June.		
	Average.	1876.	Departure from Average.	Average.	1876.	Departure from Average.	Average.	1876.	Departure from Average.
	d.	d.	d.	d.	d.	d.	d.	d.	d.
N.W.	2¼	3	+ ¾	1½	2	+ ½	2	4	+2
N.	4	2	−2	4½	5	+ ½	3½	5	+1½
N.E.	6	3	−3	7	8	+1	3½	5	+1½
E.	3¼	3	− ¼	2½	7	+4½	2½	2	− ½
S.E.	2	1	−1	1½	2	+ ½	1½	2	+ ½
S.	2¼	7	+4¾	2½	0	−2½	2½	3	+ ½
S.W.	6½	7	+ ½	7½	3	−4½	10	6	−4
W.	2¼	4	+1¾	2	4	+2	3½	3	− ½
Calm (nearly.)	1	0	−1	2	0	−2	1½	0	−1½

The sign + denotes excesses over averages; in the month of April the largest numbers with this sign are opposite to S., in May are E. and its compounds, and in June are N. and its compounds.

The sign − denotes defects below averages; in April the largest numbers with this sign are opposite to N. and N.E.; in May are S. and S.W.; and in June S.W.

1876. Months.	Temperature of Air. Mean.	Temperature of Air. Diff. from average of 105 years.	Temperature of Air. Diff. from average of 35 years.	Temperature of Evaporation. Mean.	Temperature of Evaporation. Diff. from average of 35 years.	Temperature of Dew Point. Mean.	Temperature of Dew Point. Diff. from average of 35 years.	Air—Daily Range. Mean.	Air—Daily Range. Diff. from average of 35 years.	Water of the Thames.	Elastic Force of Vapour. Mean.	Elastic Force of Vapour. Diff. from average of 35 years.	Weight of Vapour in a Cubic Foot of Air. Mean.	Weight of Vapour in a Cubic Foot of Air. Diff. from average of 35 years.
	°	°	°	°	°	°	°	°	°	°	in.	in.	grs.	gr.
April	47·2	−1·1	0·0	44·0	−0·1	40·4	−0·2	18·2	−0·5	50·0	0·251	−0·003	2·9	0·0
May	49·4	−3·1	−3·4	45·1	−4·0	40·5	−4·8	22·4	+1·9	53·3	0·233	−0·048	2·9	−0·5
June	58·5	+0·3	−0·4	53·8	−0·7	49·6	−1·1	22·4	+1·3	61·4	0·356	−0·014	4·0	−0·1
Means	51·7	−1·3	−1·3	47·6	−1·6	43·5	−2·0	21·0	+0·9	54·9	0·287	−0·022	3·3	−0·2

1876. Months.	Degree of Humidity. Mean.	Degree of Humidity. Diff. from average of 35 years.	Reading of Barometer. Mean.	Reading of Barometer. Diff. from average of 35 years.	Weight of a Cubic Foot of Air. Mean.	Weight of a Cubic Foot of Air. Diff. from average of 35 years.	Rain. Amount.	Rain. Diff. from average of 61 years.	Daily Horizontal movement of the Air.	Reading of Thermometer on Grass. Number of Nights it was At or below 30°.	Between 30° and 40°.	Above 40°.	Lowest Reading at Night.	Highest Reading at Night.
			in.	in.	grs.	grs.	in.	in.	Miles.				°	°
April	78	0	29·690	−0·091	542	−1	1·3	−0·4	318	8	17	5	25·1	43·0
May	72	−4	29·956	+0·173	545	+4	1·1	−1·0	279	9	16	6	25·3	44·5
June	73	−1	29·816	+0·003	532	0	1·1	−0·9	235	0	7	23	32·1	55·8
Means	74	−2	29·817	+0·028	540	+1	Sum 3·5	Sum −2·3	Mean 277	Sum 17	Sum 40	Sum 34	Lowest 25·1	Highest 55·8

Note.—In reading this table it will be borne in mind that the minus sign (−) signifies *below* the average, and that the plus sign (+) signifies *above* the average.

Field elm in leaf.	The earliest,	April 5th, at Strathfield.	The latest,	May 12th, at Milltown.
Wych elm	„	„ 16th, at Guernsey.	„	April 24th, at Oxford.
Oak	„	„ 9th, at Oxford.	„	„ 25th, at Milltown.
Lime	„	„ 8th, at Strathfield.	„	May 24th, at Milltown.
Sycamore	„	„ 5th, at Strathfield.	„	„ 7th, at Milltown.
Hawthorn	„	„ 8th, at Calcethorpe.	„	April 23rd, at Llandudno.
Hazel	„	„ 5th, at Oxford.	„	May 20th, at Milltown.
Lilac in blossom.	„	„ 1st, at Helston.	„	„ 29th Calcethorpe.
Honeysuckle	„	May 16th, at Llandudno.	„	June 20th, at Hull.
Mountain ash	„	„ 13th, at Strathfield.	„	May 24th, at Llandudno.
Laburnum	„	April 26th, at Helston.	„	„ 31st, at Calcethorpe.
Yellow broom	„	„ 9th, at Weybridge.	„	„ 28th, at Caterham.
Apple	„	„ 20th, at Llandudno.	„	„ 15th, at Milltown.
Pear	„	„ 1st, at Strathfield.	„	April 28th, at Hull.
Plum	„	„ 10th, at Milltown.	„	May 8th, at Silloth.
Cherry	„	„ 6th, at Strathfield.	„	„ 9th, at Allenheads.
Wheat in ear.	„	June 15th, at Helston	„	June 23rd, Llandudno.
Wheat in flower.	„	„ 22nd, at Weybridge.	„	„ 30th, at Calcethorpe.
Barley in ear.	„	„ 23rd, at Llandudno.	„	„ 27th, at Calcethorpe.
Oats	„	„ 20th, at Weybridge.	„	„ 30th, at Strathfield.
Cuckoo arrived.	„	April 1st, at Helston.	„	May 6th, at Bywell.
Swallow	„	„ 8th, at Helston.	„	„ 20th, at Allenheads.
Nightingale	„	„ 19th, at Cardington.	„	„ 23rd, at Streatley.

MONTHLY METEOROLOGICAL TABLE FOR THE QUARTER ENDING JUNE 30TH, 1876.

The Observations have been reduced to Mean values by Glaisher's Barometrical and Diurnal Range Tables, and the Hygrometrical results have been deduced from the fifth edition of his Hygrometrical Tables.

Names of Stations and Observers.	Height of Station above Sea Level.	Year 1876. Months.	Pressure of Atmosphere in Month. Mean.	Pressure of Atmosphere in Month. Range.	Temperature of Air in Month. Highest.	Lowest.	Range.	Mean Of all Highest.	Mean Of all Lowest.	Mean Daily Range.	Mean Temperature. Air.	Mean Temperature. Dew Point.	Vapour. Elastic Force.	Vapour. In a cubic foot of Air. Mean.	Vapour. In a cubic foot of Air. Short of Saturation.	Mean Degree of Humidity. Sat^{n}. = 100.	Mean Weight of a cubic foot of Air.	Mean Reading of Thermometer. Maximum in Rays of Sun.	Mean Reading of Thermometer. Minimum on Grass.	Wind. Estimated Strength.	Wind. Relative Proportion of N.	E.	S.	W.	Mean Amount of Ozone.	Mean Amount of Cloud.	Rain. Number of Days it fell.	Rain. Amount collected.
	feet.		in.	in.	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°									in.
GUERNSEY, Samuel Elliott Hoskins, Esq., M.D., F.R.S., F.M.S.	204	April	29·660	1·588	59·0	33·0	26·0	53·1	43·4	9·7	46·5	42·9	·277	3·2	0·5	88	543	—	—	1·5	6	5	9	10	3·8	4·5	18	2·00
		May	29·891	0·738	62·0	39·5	22·5	55·2	45·3	9·9	48·4	44·5	·293	3·4	0·6	87	545	—	—	1·7	14	10	1	6	3·4	2·5	6	0·49
		June	29·800	0·495	74·0	47·0	27·0	62·4	50·7	11·7	54·5	49·7	·357	4·0	0·7	84	536	—	—	1·2	9	5	6	10	3·8	4·0	10	1·03
HELSTON (Cornwall), Matthew P. Moyle, Esq., M.R.C.S.	106	April	29·743	1·486	60·0	33·0	27·0	55·1	40·5	14·6	47·9	43·9	·287	3·2	0·6	87	542	72·2	37·9	2·0	6	4	11	9	6·3	4·2	15	3·08
		May	30·058	0·742	77·0	35·0	42·0	63·4	42·2	21·2	52·1	42·2	·269	3·1	1·3	70	544	73·4	40·5	2·4	10	14	2	5	5·1	2·0	1	0·80
		June	29·856	0·458	86·0	41·0	45·0	69·8	48·0	21·8	57·5	50·0	·361	4·1	1·3	76	534	98·5	45·5	2·2	8	3	8	11	3·6	3·2	10	0·71
TRURO (Cornwall), C. Barham, Esq., M.D., F.M.S.	43	April	29·802	1·708	61·0	29·0	32·0	53·4	41·3	12·1	46·4	42·1	·269	3·2	0·4	86	545	—	—	2·7	7	5	7	11	—	6·6	20	3·17
		May	30·095	0·797	68·0	31·0	37·0	61·6	41·1	20·5	49·8	41·2	·260	2·9	1·1	73	547	—	—	2·6	10	13	3	5	—	4·2	3	0·13
		June	29·932	0·436	80·0	39·0	41·0	66·8	49·3	17·5	55·4	48·7	·345	3·9	1·1	79	538	—	—	2·4	10	3	8	9	—	6·0	13	0·94
PLYMOUTH (Devon), John Merrifield, Esq., F.R.A.S., F.M.S., LL.D.	69	April	29·863	1·549	58·0	32·5	25·5	54·2	42·2	12·0	46·4	43·0	·275	3·2	0·5	86	545	—	40·7	2·4	7	6	8	9	—	6·1	20	3·61
		May	30·136	0·752	68·0	36·0	32·0	59·4	43·7	15·7	49·7	44·1	·290	3·3	0·7	82	548	—	41·3	2·9	10	12	2	7	—	3·8	4	0·34
		June	30·006	0·516	79·5	43·0	36·5	66·7	51·3	15·4	56·5	50·3	·366	4·1	1·0	80	538	—	48·3	2·4	7	4	9	10	—	5·7	15	1·63
EASTBOURNE (Sussex), Miss W. L. Hall.	12	April	29·836	1·284	64·3	30·0	34·3	56·6	41·3	15·3	48·0	43·2	·278	3·2	0·6	84	545	109·8	34·9	0·2	2	8	11	9	2·9	—	14	1·96
OSBORNE (Isle of Wight), J. R. Mann, Esq.	172	April	29·673	1·632	64·0	30·1	33·9	56·6	40·4	16·2	47·0	44·1	·288	3·3	0·4	89	542	106·7	38·6	0·2	4	5	12	9	—	5·5	13	1·62
		May	29·949	0·754	72·6	32·8	39·8	62·5	40·4	22·1	50·8	45·1	·309	3·4	0·6	81	543	117·1	37·0	0·2	13	10	4	4	—	3·8	5	0·15
		June	29·807	0·480	84·9	42·2	42·7	71·1	49·1	22·0	58·5	53·7	·414	4·6	0·9	84	532	124·9	45·1	0·1	6	6	9	9	—	5·1	10	1·10
SOUTH BOURNE, (near) Bournemouth (Hants), T. A. Compton, Esq., M.D., B.A., F.M.S.	128	April	29·861	1·510	61·9	33·5	28·4	54·0	43·0	11·0	47·5	41·2	·259	3·0	0·7	79	545	—	—	—	8	5	8	9	—	3·5	9	1·20
		May	29·930	0·750	68·6	30·7	37·9	60·7	39·6	21·1	49·4	37·8	·226	2·6	1·4	64	545	—	—	—	16	9	2	4	—	2·4	6	0·63
		June	29·890	0·520	77·9	40·2	37·7	66·5	50·1	16·4	57·3	46·4	·314	3·5	1·7	67	535	—	—	—	9	6	6	9	—	2·7	9	0·95
HASTINGS (Sussex), Alex. E. Murray, Esq., F.M.S.	167	April	29·632	1·555	62·6	29·4	33·2	52·7	41·6	11·1	46·1	41·1	·260	3·0	0·6	84	544	—	37·9	1·6	5	6	11	8	—	5·1	16	1·82
		May	29·935	0·879	63·8	33·6	30·2	55·3	41·2	14·1	47·4	40·6	·253	2·9	0·8	78	547	—	37·5	2·7	12	10	4	5	—	4·4	8	1·49
		June	29·820	0·575	82·1	41·3	40·8	64·3	51·0	13·3	56·3	50·1	·363	4·1	1·0	80	535	—	48·3	1·5	9	6	7	8	—	6·2	15	1·36
TAUNTON (Somerset), James Bottomley, Esq.	80	April	29·771	1·640	66·7	26·5	40·2	57·9	40·2	17·7	47·5	44·3	·291	3·3	0·5	89	543	60·7	37·8	0·4	7	6	5	12	4·9	5·5	15	3·14
		May	30·057	0·751	73·5	29·0	44·5	61·7	38·8	22·9	49·4	42·4	·272	3·1	1·0	77	547	74·3	35·2	2·8	9	12	2	8	2·2	4·6	1	0·13
SALISBURY (Wilton House), T. Challis, Esq.	186	April	29·681	1·676	67·5	28·0	39·5	57·9	38·7	19·2	47·4	40·6	·253	3·0	0·8	78	542	103·4	36·4	1·6	9	5	4	12	3·7	6·1	18	2·37
		May	29·933	0·772	74·0	27·5	46·5	64·1	36·9	27·2	49·6	41·2	·260	3·0	1·0	73	544	116·8	32·9	1·2	9	16	2	4	2·6	4·8	5	0·29
		June	29·706	0·526	85·0	34·5	50·5	73·3	45·5	27·8	58·0	49·3	·352	3·9	1·5	73	533	123·2	42·2	1·5	13	3	4	10	3·8	5·4	8	1·04
BARNSTAPLE (Devon), T. Mackrell, Esq.	43	April	29·806	1·660	67·0	33·5	33·5	57·5	44·1	13·4	47·8	44·0	·288	3·2	0·5	87	544	—	—	1·2	4	7	11	8	—	4·0	16	2·83
		May	30·101	0·770	70·0	35·0	35·0	62·4	45·6	16·8	52·5	41·4	·261	2·9	1·5	66	544	—	—	1·4	11	12	1	7	—	3·0	5	0·64
		June	29·950	0·549	84·0	46·0	38·0	69·6	53·1	16·5	59·5	50·0	·362	4·1	1·5	71	534	—	—	1·4	6	5	10	9	—	3·7	12	1·25
CATERHAM (Surrey), James Adam, Esq., M.D.	660	April	29·190	1·570	—	25·0	—	—	38·7	—	48·7	42·7	·274	3·2	0·6	80	532	66·5	—	1·9	4	6	7	13	3·1	2·0	18	1·92
		May	29·469	0·780	—	29·0	—	—	37·9	—	49·4	38·6	·255	2·8	1·2	66	536	64·1	—	1·8	8	15	2	6	2·7	2·0	8	1·30
		June	29·342	0·550	—	37·0	—	—	48·3	—	59·2	49·3	·359	4·0	1·7	70	523	77·3	—	1·4	9	6	4	11	0·7	2·3	12	1·40

Names of Stations and Observers.	Height of Station above Sea Level.	Year 1876. Months.	Pressure of Atmosphere in Month. Mean.	Pressure of Atmosphere in Month. Range.	Temperature of Air in Month. Highest.	Temperature of Air in Month. Lowest.	Temperature of Air in Month. Range.	Temperature of Air in Month. Mean of all Highest.	Temperature of Air in Month. Mean of all Lowest.	Temperature of Air in Month. Mean Daily Range.	Mean Temperature. Air.	Mean Temperature. Dew Point.	Vapour. Elastic Force.	Vapour. In a Cubic foot of Air. Mean.	Vapour. In a Cubic foot of Air. Grains of Short Saturation.	Mean Degree of Humidity. Sat° = 100.	Mean Weight of a cubic foot of Air.	Mean Reading of Thermometer. Maximum in Rays of Sun.	Mean Reading of Thermometer. Minimum on Grass.	Wind. Estimated Strength.	Wind. Relative Proportion of N.	Wind. Relative Proportion of E.	Wind. Relative Proportion of S.	Wind. Relative Proportion of W.	Mean Amount of Ozone.	Mean Amount of Cloud.	Rain. Number of Days it fell.	Rain. Amount collected.
	feet.		in.	in.	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°								in.
RAMSGATE (St. Augustine's Monastery), Rev. T. Hugh Quelch, O.S.B.	108	April	29·760	1·515	61·4	29·5	31·9	53·8	42·2	11·6	47·2	41·9	·266	3·1	0·6	83	544	103·8	34·3	1·4	5	7	8	10	—	5·7	9	1·57
		May	30·008	0·889	66·3	38·4	27·9	55·8	44·5	11·3	49·7	43·3	·282	3·2	0·8	79	546	109·3	39·2	1·8	13	12	3	3	—	5·0	8	1·08
		June	29·890	0·598	74·9	44·1	30·8	64·5	52·2	12·3	57·4	51·5	·381	4·3	0·9	81	535	109·9	46·8	1·4	10	5	3	7	—	5·8	11	1·16
STRATHFIELD TURGISS (Hants), Rev. C. H. Griffith, M.A., F.M.S.	197	April	29·673	1·625	68·7	30·1	38·6	53·5	39·4	16·1	46·7	40·7	·254	3·0	0·5	81	543	103·0	34·7	0·7	7	6	7	10	3·5	6·0	14	1·98
		May	29·927	0·802	70·7	29·8	40·9	60·5	40·2	20·3	49·2	40·3	·250	2·9	1·1	71	545	111·5	33·2	0·8	11	12	2	6	3·6	5·4	4	0·31
		June	29·792	0·548	85·1	35·5	49·6	69·2	47·6	21·6	57·4	48·4	·340	3·8	1·4	72	534	121·1	44·1	0·6	12	3	5	10	2·5	5·7	11	2·04
WEYBRIDGE HEATH (Surrey), William F. Harrison, Esq., F.M.S.	150	April	29·744	1·615	73·0	27·8	45·2	57·6	38·5	19·1	47·2	41·1	·258	3·0	0·7	79	543	89·5	36·1	0·8	7	4	12	7	0·8	6·1	15	1·65
		May	30·024	0·811	74·0	28·3	45·7	61·8	36·6	25·2	48·5	40·4	·253	2·9	1·1	74	547	102·6	33·5	0·7	12	10	4	5	1·7	5·9	7	0·73
		June	29·853	0·566	88·5	36·0	52·5	71·3	47·1	24·2	57·9	50·5	·367	4·1	1·3	76	534	105·6	45·2	0·6	8	5	10	7	2·2	5·2	12	1·75
EAST TILBURY Vicarage (Essex), Rev. R. Tyas, M.A., LL.D.	29	April	29·849	1·592	70·4	28·2	42·2	59·2	32·8	26·4	45·8	40·9	·257	2·9	0·5	84	547	97·3	36·4	1·0	2	11	11	6	—	5·6	10	1·27
		May	30·102	0·762	73·5	29·0	44·5	60·0	40·2	19·8	49·0	41·8	·236	3·0	1·0	76	548	111·8	37·4	0·8	7	16	5	3	—	4·6	7	0·85
		June	29·970	0·572	84·3	42·0	42·3	70·3	49·6	20·7	58·3	51·7	·392	4·3	1·0	74	535	116·3	46·2	0·3	7	7	4	12	—	5·0	9	1·22
MARLBOROUGH, The Green (Wilts), Rev. Thomas A. Preston, M.A., F.M.S.	474	April	29·366	1·557	65·9	28·7	37·2	54·6	39·5	15·1	45·7	40·8	·255	2·9	0·6	84	558	98·1	34·3	0·2	6	4	8	12	—	6·1	19	3·37
		May	29·632	0·756	69·7	29·8	39·9	58·8	38·5	20·3	47·7	40·1	·248	2·8	0·9	75	541	111·5	35·1	0·2	14	11	1	5	—	5·2	7	1·10
		June	29·492	0·229	82·7	36·5	46·2	68·6	47·8	20·8	56·8	48·7	·344	3·9	1·3	75	528	119·2	44·9	0·2	11	4	4	11	—	5·3	9	1·98
BECKENHAM (Kent), C. O. F. Cator, Esq., M.A., F.M.S.	170	April	29·659	1·602	70·7	27·1	43·6	58·3	37·8	20·5	46·8	41·0	·257	3·0	0·7	81	542	—	—	—	4	6	9	11	—	6·1	14	1·69
		May	29·943	0·826	73·8	27·6	46·2	61·2	35·3	25·9	47·1	39·5	·242	2·8	0·9	76	547	—	—	—	11	13	2	5	—	5·8	6	1·07
		June	29·815	0·561	86·6	34·9	51·7	71·9	46·7	25·2	57·5	50·0	·361	4·1	1·2	76	533	—	—	—	6	7	5	12	—	5·1	11	1·35
BLACKHEATH (London), James Glaisher, Esq., F.R.S.	160	April	29·677	1·593	73·1	29·9	43·2	57·6	40·2	17·4	47·5	40·1	·248	2·8	0·9	76	542	93·4	37·4	1·3	5	5	11	9	—	5·7	12	1·60
		May	29·944	0·820	73·4	31·9	41·5	60·7	40·2	20·5	49·1	41·6	·258	2·9	1·1	74	545	105·7	37·9	1·0	10	12	2	7	—	4·8	6	1·22
		June	29·804	0·550	84·9	40·9	44·0	69·4	49·5	19·9	58·0	50·2	·365	4·0	1·4	76	533	107·2	47·4	0·8	10	5	7	8	—	5·5	11	1·24
STREATLEY VICARAGE (Berks), Rev. J. Slatter, M.A., F.R.A.S., F.M.S.	150	April	29·684	1·611	70·3	29·7	40·6	56·9	40·7	16·2	48·1	41·6	·262	3·0	0·8	78	541	—	—	1·6	8	6	8	8	—	5·9	16	2·85
		May	29·984	0·779	71·3	29·3	42·0	60·0	38·0	22·0	48·8	39·9	·247	2·8	1·0	72	546	—	—	1·6	12	11	2	6	—	6·0	7	0·63
		June	29·828	0·475	86·9	36·2	38·7	70·9	49·4	21·5	58·0	50·6	·370	4·1	1·3	77	533	—	—	1·7	8	7	5	10	—	6·3	11	2·06
CHISWICK (Middlesex), J. K. L. M. Farquhar, Esq.	25	April	29·795	1·622	72·0	30·0	42·0	58·8	38·0	20·8	47·0	41·4	·261	3·0	0·7	82	545	107·5	32·7	0·8	3	7	7	13	—	6·7	9	2·06
		May	30·045	0·812	72·0	28·5	43·5	60·3	35·2	25·1	47·2	41·6	·262	3·0	0·7	81	549	107·1	33·2	0·9	7	15	3	6	—	6·6	5	0·79
		June	29·948	0·556	85·5	34·0	51·5	71·0	48·3	22·7	58·0	50·4	·367	4·1	1·3	76	535	120·2	42·4	0·8	9	4	8	9	—	6·3	7	1·31
CAMDEN SQUARE (London), G. J. Symons, Esq., F.M.S.	123	April	29·724	1·602	71·1	30·7	40·4	57·5	41·5	16·0	48·2	41·5	·261	3·0	0·9	78	542	102·7	36·3	—	7	4	10	9	—	6·2	11	1·20
		May	30·000	0·788	71·1	32·8	38·3	62·0	40·5	21·5	49·7	41·3	·261	3·0	1·0	73	546	119·5	35·7	—	18	4	2	7	—	5·3	6	0·94
		June	29·857	0·564	84·8	39·4	45·4	71·0	50·3	20·7	59·0	49·9	·359	4·1	1·5	72	533	124·1	47·3	—	9	3	7	11	—	5·6	11	1·27
OXFORD Observatory, Rev. R. Main, M.A., F.R.S., F.R.A.S.	210	April	29·617	1·607	67·0	31·0	36·0	55·3	38·6	16·7	46·8	41·9	·266	3·0	0·6	84	542	101·1	37·1	1·0	5	6	9	10	3·4	7·0	19	2·89
		May	29·918	0·794	69·9	31·1	38·8	59·7	40·5	19·2	49·9	41·5	·261	2·9	1·2	72	544	112·3	36·7	0·8	11	11	3	6	4·6	5·6	8	0·79
		June	29·742	0·486	85·3	37·8	47·5	69·4	50·0	19·4	59·2	50·8	·373	4·2	1·5	74	530	117·3	47·6	0·7	9	4	7	10	3·8	6·9	11	2·02
GLOUCESTER, E. Toller, Esq., M.D.	100	April	29·761	1·643	74·0	28·4	45·6	59·8	36·1	23·7	45·9	36·6	·217	2·5	0·7	71	546	96·6	37·3	0·9	7	6	5	12	1·6	6·7	17	2·34
		May	30·087	0·784	77·5	29·0	48·5	64·1	38·9	26·1	48·5	43·9	·288	3·2	0·8	82	547	111·0	34·3	1·0	9	23	4	5	2·2	5·2	7	1·33
		June	29·919	0·350	—	35·0	—	—	49·6	—	59·0	51·4	·380	4·3	1·3	76	533	129·8	—	0·8	9	6	4	11	2·6	5·9	10	0·69
ROYSTON (Hertfordshire), Hale Wortham, Esq., F.R.A.S., F.M.S.	269	April	29·572	1·592	70·2	28·0	42·2	58·8	37·9	20·9	46·7	41·8	·266	3·1	0·6	84	541	—	—	—	6	5	11	8	—	6·2	14	2·87
		May	29·870	0·792	72·8	29·2	43·6	60·7	37·5	23·2	48·1	39·9	·246	2·8	1·0	74	545	—	—	—	15	8	3	5	—	4·9	7	0·99
		June	29·737	0·351	84·7	36·1	48·6	71·3	47·4	23·9	57·6	50·3	·366	4·1	1·2	77	532	—	—	—	11	3	6	10	—	5·8	10	1·64
CARDINGTON (near Bedford), Mr. MacLaren, Assistant to S. C. Whitbread, Esq., F.R.S.	105	April	29·738	1·616	69·0	29·4	39·6	57·3	39·2	18·1	46·9	42·9	·276	3·1	0·6	87	544	86·0	33·8	1·6	6	6	8	10	—	6·8	18	3·75
		May	30·030	0·794	72·0	31·4	40·6	59·9	39·6	20·1	49·4	43·3	·241	2·8	1·2	68	547	93·9	33·1	1·7	11	12	1	7	—	5·1	6	0·45
		June	29·880	0·330	86·0	36·0	50·0	70·7	49·2	21·5	58·9	50·9	·374	4·2	1·1	75	533	104·7	43·4	1·1	7	6	6	11	—	6·1	12	1·39
LAMPETER (Cardiganshire), St. David's College, Prof. A. W. Scott, M.A.	420	April	29·425	1·569	66·0	27·0	39·0	56·1	38·3	17·8	45·7	39·9	·247	2·8	0·7	81	540	94·5	—	—	5	9	9	7	—	—	15	2·83
		May	29·530	0·730	70·5	26·0	44·5	61·7	36·5	25·2	48·5	39·1	·239	2·7	1·2	70	542	117·8	—	—	10	11	2	8	—	—	6	0·68
		June	29·562	0·576	82·0	32·0	50·0	69·3	43·5	25·8	56·0	48·1	·339	3·7	1·3	74	531	115·8	—	—	7	5	8	10	—	—	5	1·07
CAMBRIDGE, J. W. L. Glaisher, Esq., M.A., F.R.S.	40	April	29·779	1·615	72·0	25·3	46·7	57·7	38·9	18·8	47·3	44·6	·294	3·3	0·4	91	544	114·7	34·7	1·6	6	5	11	8	—	6·3	18	2·05
		May	30·072	0·808	72·8	29·6	43·2	62·8	38·7	24·1	49·7	—	—	—	—	—	—	132·4	34·8	1·5	10	11	5	5	—	5·4	11	0·47
		June	29·920	0·540	84·0	38·0	46·0	71·5	49·2	22·3	58·6	49·1	·291	4·3	1·1	79	534	137·5	44·6	1·5	9	7	6	8	—	6·2	11	1·63

Names of Stations and Observers.	Height of Station above Sea Level.	Year 1876. Months.	Pressure of Atmosphere in Month. Mean.	Pressure of Atmosphere in Month. Range.	Temperature of Air in Month. Highest.	Temperature of Air in Month. Lowest.	Temperature of Air in Month. Range.	Temperature of Air in Month. Mean of all Highest.	Temperature of Air in Month. Mean of all Lowest.	Temperature of Air in Month. Mean Daily Range.	Mean Temperature. Air.	Mean Temperature. Dew Point.	Vapour. Elastic Force.	Vapour. In a cubic foot of Air. Mean.	Vapour. In a cubic foot of Air. Amt. of Saturation.	Mean Degree of Humidity. Sat. = 100.	Mean Weight of a cubic foot of Air.	Mean Reading of Thermometer. Maximum in Rays of Sun.	Mean Reading of Thermometer. Minimum on Grass.	Wind. Estimated Strength.	Wind. Relative Proportion of N.	Wind. Relative Proportion of E.	Wind. Relative Proportion of S.	Wind. Relative Proportion of W.	Mean Amount of Ozone.	Mean Amount of Cloud.	Rain. Number of Days it fell.	Rain. Amount collected.
	feet.		in.	in.	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°									in.
SOMERLEYTON RECTORY (Suffolk), Rev. C. J. Steward, F.M.S.	50	May	30·068	0·782	71·0	28·7	42·3	57·8	40·6	17·2	47·8	42·8	·275	3·2	0·5	84	549	—	32·2	1·1	8	13	4	6	7·7	4·4	11	0·92
		June	29·926	0·572	76·8	35·8	41·0	65·7	47·3	18·4	55·7	50·5	·368	4·1	0·8	83	537	—	39·5	1·1	8	11	8	5	7·7	4·8	12	1·60
NORWICH (Norfolk), John Quinton, Esq., Jun.	42	April	29·798	1·556	66·8	29·2	37·6	54·8	40·1	14·7	46·4	44·1	·289	3·3	0·3	92	545	—	—	—	5	10	8	7	—	—	16	2·80
		May	30·084	0·822	72·0	32·0	40·0	56·6	42·4	14·2	48·4	41·3	·260	3·0	0·9	77	548	—	—	—	14	7	4	6	—	—	9	0·39
		June	29·933	0·578	81·2	39·0	42·2	67·0	49·9	17·1	57·2	51·6	·383	4·3	1·0	82	536	—	—	—	11	8	7	4	—	—	12	1·73
LEICESTER (Town Museum), W. J. Harrison, Esq., F.G.S.	245	April	29·574	1·582	68·0	27·7	40·3	54·2	39·6	15·2	46·2	38·5	·234	2·7	0·9	75	542	103·4	32·1	0·9	6	6	8	10	—	6·7	19	2·77
		May	29·886	0·847	67·6	32·1	35·5	57·9	40·3	17·6	48·6	39·0	·238	2·7	1·2	69	545	115·7	32·7	0·8	12	7	5	7	—	6·0	7	0·64
		June	29·716	0·695	82·2	38·4	43·8	66·6	48·7	17·9	57·1	46·6	·317	3·6	1·6	68	532	123·6	42·0	1·0	7	7	6	10	—	6·3	14	1·97
WISBECH (Cambridgeshire), S. H. Miller, Esq., F.R.A.S., F.M.S.	14	April	29·815	1·574	70·5	29·7	40·8	57·3	39·4	17·9	47·0	42·1	·288	3·1	0·6	84	545	105·7	35·4	0·6	6	7	9	8	4·4	6·2	18	4·85
		May	30·121	0·780	75·0	33·0	42·0	61·7	41·7	20·0	50·4	43·2	·278	3·3	0·8	76	547	114·7	36·2	0·5	12	7	6	6	4·4	5·3	9	1·10
		June	29·958	0·524	82·8	39·0	43·8	70·6	49·4	21·2	58·3	52·5	·396	4·5	1·0	81	535	115·3	44·9	0·5	10	4	8	8	4·4	6·5	13	2·80
NOTTINGHAM, M.O. Tarbotton, Esq., C.E., F.G.S., F.M.S.	183	April	29·622	1·560	69·4	26·9	42·5	57·1	39·2	17·9	46·6	41·5	·262	3·0	0·6	83	542	92·8	35·9	0·5	6	9	8	7	3·0	7·2	21	2·75
		May	29·946	0·780	73·6	31·1	42·5	60·0	40·0	20·0	48·6	39·6	·244	2·8	1·1	71	546	111·6	36·3	0·4	8	11	6	6	3·9	6·0	11	0·56
HOLKHAM (Norfolk), John Davidson, Esq., Assistant to the Earl of Leicester.	39	April	29·770	1·538	66·9	24·3	42·6	55·1	35·3	19·8	45·0	39·8	·245	2·8	0·6	82	546	105·9	33·6	1·8	9	5	10	6	—	5·6	17	4·47
		May	30·075	0·780	69·0	26·5	42·5	56·5	38·3	18·2	47·0	39·9	·247	2·8	0·9	77	550	112·4	35·8	1·8	16	8	3	4	—	5·2	8	0·80
		June	29·919	0·474	76·8	32·3	44·5	65·2	45·1	20·1	54·6	47·9	·333	3·7	1·0	78	538	124·7	44·0	1·6	12	5	8	5	—	5·9	11	2·25
LLANDUDNO (Carnarvonshire), James Nicol, Esq., M.D., and Thomas Dalton, Esq., M.D.	100	April	29·716	1·570	65·3	31·9	33·4	55·2	41·0	14·2	47·0	39·6	·243	2·8	0·9	76	543	—	—	0·6	4	7	8	11	—	5·9	12	3·08
		May	30·067	0·784	67·3	31·4	35·9	57·7	42·2	15·5	49·3	40·4	·252	2·9	1·2	71	547	—	—	0·9	4	17	2	8	—	4·4	6	0·26
		June	29·863	0·610	86·0	42·4	43·6	66·6	50·1	16·5	57·3	48·1	·335	3·8	1·4	71	534	—	—	0·8	8	4	3	15	—	5·3	12	2·16
CALCETHORPE MANOR (near) Louth (Lincolnshire), D. Grant Briggs, Esq., F.M.S.	382	April	29·429	1·513	66·4	23·6	42·8	52·2	38·0	14·2	43·9	39·5	·242	2·8	0·5	84	542	107·5	34·0	1·0	7	9	8	6	7·7	6·2	19	3·60
		May	29·740	0·910	65·5	31·1	34·4	54·6	39·3	15·3	45·8	40·9	·256	2·9	0·6	84	545	116·8	34·2	0·7	12	8	5	6	8·9	6·3	10	1·16
		June	29·572	0·667	73·4	37·9	35·5	63·5	47·0	16·5	54·0	48·9	·346	3·9	0·8	82	533	121·8	43·5	0·7	5	7	10	8	8·1	6·0	13	2·71
LIVERPOOL OBSERVATORY, John Hartnup, Esq., F.R.A.S.	197	April	29·600	1·567	66·0	31·5	34·5	53·2	40·7	12·5	45·5	39·3	·241	2·8	0·6	79	543	—	—	1·2	4	8	8	10	—	6·1	17	2·46
		May	29·946	0·860	63·2	35·6	27·6	56·1	42·8	13·3	48·4	38·8	·236	2·7	1·1	70	546	—	—	1·1	8	9	2	12	—	4·5	5	0·40
		June	29·754	0·649	81·9	44·0	37·9	63·5	50·3	13·2	55·5	45·8	·310	3·5	1·3	70	535	—	—	1·1	4	5	5	16	—	5·9	13	1·65
ECCLES (near Manchester), T. Mackereth, Esq., F.R.A.S., F.M.S.	145	April	29·675	1·540	70·8	27·1	43·7	55·5	38·8	16·7	46·1	40·5	·253	2·9	0·6	82	544	68·6	31·9	0·4	5	5	10	10	1·8	7·2	18	3·18
		May	30·007	0·830	70·9	28·0	42·9	59·5	38·3	21·2	48·1	40·2	·249	2·9	1·0	74	547	75·3	31·9	0·2	8	10	5	8	1·7	6·0	9	1·08
		June	29·815	0·602	84·6	37·5	47·1	67·5	46·2	21·1	55·8	47·6	·330	3·8	1·2	75	535	85·1	39·0	0·8	7	6	5	12	1·9	6·6	15	2·83
MOORSIDE OBSERVATORY, HALIFAX (Yorkshire), Louis J. Crossley, Esq., F.R.A.S.	429	April	29·372	1·557	69·0	28·5	40·5	53·1	38·8	14·3	44·3	39·9	·247	2·9	0·4	85	540	88·4	34·4	1·2	5	9	5	11	1·2	7·1	17	2·61
		May	29·706	0·864	68·8	29·6	39·2	57·4	40·7	16·7	47·7	37·2	·222	2·6	1·2	68	543	99·7	35·3	1·4	9	12	1	9	1·1	6·7	8	1·30
BERMERSIDE OBSERVATORY, HALIFAX (Yorkshire), Edward Crossley, Esq., F.R.A.S.	520	April	29·343	1·540	71·0	26·5	44·5	53·1	38·0	15·1	44·0	39·6	·244	2·8	0·5	84	538	92·1	—	0·4	5	12	7	6	—	6·6	16	3·03
		June	29·412	0·592	81·2	38·8	42·4	66·7	46·6	20·1	54·9	49·0	·348	4·0	0·9	80	529	111·8	—	0·6	3	8	7	12	—	5·8	10	3·30
HULL (Yorkshire), Mr. E. Peak.	12	April	29·833	1·568	68·6	27·0	41·0	53·6	39·4	14·2	45·4	40·3	·249	2·9	0·6	83	547	78·2	35·3	—	—	—	—	—	1·1	1	17	2·08
		May	30·148	0·856	69·0	29·0	40·0	58·1	41·1	17·0	48·9	40·8	·256	2·9	1·0	74	549	88·2	36·2	—	—	—	—	—	2·7	—	10	1·25
		June	29·960	0·704	76·0	39·0	37·0	67·6	49·1	18·5	56·7	49·6	·355	4·0	1·2	77	537	94·4	45·5	—	—	—	—	—	2·4	—	12	2·05
STONYHURST (Lancashire), Rev. S. J. Perry, F.M.S., F.R.S., F.R.A.S.	363	April	29·421	1·546	68·3	25·0	43·3	54·0	38·7	15·3	45·0	40·7	·253	2·9	0·5	85	540	103·1	35·6	—	5	7	5	13	—	7·2	21	2·68
		May	29·762	0·884	67·6	29·2	37·7	58·6	39·3	19·3	47·8	40·9	·256	3·0	0·7	78	543	116·7	35·6	—	12	11	1	7	—	6·0	8	0·64
		June	29·570	0·635	81·1	39·0	42·1	66·9	47·3	19·6	55·4	48·5	·345	3·8	1·1	78	532	125·3	44·9	—	2	4	8	16	—	6·8	13	4·60
LEEDS (Philosophical Hall) (Yorkshire), Louis C. Miall, Esq.	187	April	29·642	1·614	72·0	30·0	42·0	56·9	39·2	17·7	46·5	41·6	·263	3·1	0·6	84	542	74·5	—	1·2	5	9	6	10	—	6·2	15	2·20
		May	29·990	0·900	72·0	34·0	38·0	63·7	41·8	21·9	51·2	41·2	·260	3·0	1·2	69	544	86·8	—	1·4	9	10	2	10	—	5·9	8	0·81
		June	29·788	0·638	85·0	43·0	42·0	70·2	49·7	20·5	58·9	50·9	·374	4·2	1·2	75	531	92·8	—	1·4	4	5	7	14	—	4·1	12	2·12
BRADFORD (Yorkshire), J. McLandsborough, Esq., C.E., F.G.S.	366	April	29·393	1·553	68·8	26·2	38·6	52·7	40·5	12·4	45·2	40·3	·249	2·9	0·6	83	539	74·2	—	0·8	6	8	8	8	—	7·3	20	2·39
		May	29·746	0·850	66·0	32·0	34·0	55·9	43·7	13·2	48·1	37·8	·227	2·6	1·2	68	545	82·6	—	0·9	9	10	2	10	—	6·1	9	0·76
		June	29·567	0·574	78·4	42·4	36·0	65·2	50·4	14·8	56·6	45·8	·309	3·4	1·3	67	530	95·3	—	0·6	8	6	5	11	—	6·1	11	2·04

Names of Stations and Observers.	Height of Station above Sea Level.	Year 1876.	Months.	Pressure of Atmosphere in Month.			Temperature of Air in Month.						Mean Temperature.	Vapour.			Mean Degree of Humidity. Sat^{n}. = 100.	Mean Weight of a cubic foot of Air.	Mean Reading of Thermometer.		Estimated Strength.	Wind.				Mean Amount of Ozone.	Mean Amount of Cloud.	Rain.	
				Mean.	Range.	Highest.	Lowest.	Range.	Mean.			Daily Range.	Air.	Dew Point.	Elastic Force.	Mean.	Short of Saturation. In a cubic foot of Air.		Maximum in Rays of Sun.	Minimum on Grass.		N.	E.	S.	W.			Number of Days it fell.	Amount collected.
	feet.			in.	in.	°	°	°	°	°	°	°	°	°	in.	grs.	gr.	grs.		°								in.
RAMSGATE (St. Augustine's Monastery), Rev. T. Hugh Quelch, O.S.B.	108	April		29·760	1·515	61·4	29·5	31·9	53·8	42·2	11·6	47·2	43·8	41·9	·266	3·1	0·6	83	544	103·8	84·3	1·4	5	7	13	8	—	5·7	9	1·57
		May		29·808	0·880	68·4	38·6	37·9	55·8	44·5	11·3	49·7	47·8	43·3	·282	3·2	0·8	79	546	109·9	39·9	1·9	13	11	9	6	—	5·0	8	1·06
		June		29·850	0·566	74·9	44·1	30·8	64·5	52·2	12·3	57·4	51·5	47·3	·361	4·3	0·9	81	555	109·9	46·8	1·4	11	5	8	5	—	5·8	11	1·16
STRATHFIELD TURGISS (Hants), Rev. C. H. Griffith, M.A., F.M.S.	197	April		29·673	1·625	68·7	30·1	38·6	55·5	39·4	16·1	46·7	40·7	40·7	·254	3·0	0·5	81	543	103·0	34·7	0·7	10	7	8	5	3·5	5·6	14	1·98
		May		29·927	0·902	70·7	29·8	40·9	60·5	40·2	20·3	49·2	46·5	40·3	·250	2·9	1·1	71	546	111·5	33·2	0·8	6	10	23	10	3·6	5·4	11	0·81
		June		29·792	0·648	85·1	35·5	49·6	69·2	47·6	21·6	57·4	54·4	48·4	·340	3·8	1·4	72	554	121·1	44·1	0·6	10	3	5	10	2·5	5·7	11	2·04
WEYBRIDGE HEATH (Surrey), William F. Harrison, Esq., F.M.S.	150	April		29·744	1·613	73·0	27·8	45·2	57·8	38·5	19·1	47·2	41·1	37·2	·238	3·0	0·7	79	543	89·5	30·1	0·8	7	4	12	7	0·8	6·1	15	1·65
		May		29·924	0·811	74·0	28·8	45·7	61·8	36·6	25·2	48·5	40·4	36·9	·253	2·9	1·1	74	547	102·6	33·5	0·7	12	5	4	10	1·7	5·2	12	0·73
		June		29·853	0·566	88·5	36·0	52·5	71·3	47·1	24·2	57·9	50·5	46·7	·367	4·1	1·3	76	554	105·6	45·2	0·6	8	5	10	7	2·2	5·2	12	1·75
EAST TILBURY Vicarage (Essex), Rev. R. Tyas, M.A., LL.D.	23	April		29·849	1·392	70·4	28·2	42·2	59·2	36·4	22·8	45·8	40·9	36·4	·227	2·9	0·5	84	547	97·3	30·4	1·0	11	6	6	6	—	5·6	10	1·27
		May		29·902	0·762	73·5	29·0	44·5	60·0	40·2	19·8	49·0	41·8	38·0	·240	3·0	1·0	76	548	111·8	37·4	0·8	7	12	5	5	—	4·6	9	0·65
		June		29·870	0·572	84·3	42·0	42·3	70·3	49·6	20·7	58·5	51·7	46·2	·362	4·3	1·0	74	555	116·3	46·2	0·3	3	12	5	10	2·5	5·0	9	1·22
MARLBOROUGH, The Green (Wilts), Rev. Thomas A. Preston, M.A., F.M.S.	474	April		29·808	1·637	65·9	28·7	37·2	54·6	39·5	15·1	45·7	40·7	40·8	·255	2·9	0·6	84	538	98·1	34·3	0·2	6	4	8	12	4·6	6·1	19	3·37
		May		29·693	0·756	69·7	29·8	39·9	58·5	38·5	20·0	48·7	40·1	36·8	·248	2·9	0·9	75	541	111·5	35·1	0·2	14	11	5	5	5·2	5·2	7	1·10
		June		29·492	0·520	82·7	36·5	46·2	68·6	47·8	20·8	56·8	48·7	44·4	·344	3·9	1·3	75	526	119·2	44·9	0·3	11	4	1	11	4·3	5·3	9	1·08
BECKENHAM (Kent), C. O. F. Cator, Esq., M.A., F.M.S.	170	April		29·659	1·602	70·7	27·1	43·6	58·3	37·8	20·5	46·8	41·0	37·0	·237	3·0	0·7	81	542	—	—	—	—	—	—	—	—	6·1	14	1·69
		May		29·943	0·895	73·8	27·6	46·2	61·2	35·3	25·9	47·1	39·5	35·2	·232	2·8	0·9	76	547	—	—	—	—	—	—	—	—	5·8	11	1·07
		June		29·815	0·561	86·6	34·9	51·7	71·9	40·7	31·2	57·6	50·0	46·1	·361	4·1	1·2	76	553	—	—	—	—	—	—	—	—	5·8	6	1·07
BLACKHEATH (London),		April		29·677	1·203	73·1	29·0	43·2	57·8	40·3	17·5	47·8	43·0	40·1	·262	3·1	0·8	83	544	103·8	39·2	1·4	8	7	13	8	—	5·7	11	0·92
		May		30·008	0·782	71·0	28·7	42·3	57·8	40·6	17·2	47·8	43·8	40·5	·262	3·1	0·8	84	549	109·9	39·2	1·1	11	11	9	5	—	4·4	12	1·60

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BER 30TH, 1876.

more particularly
17th. On these
eir averages were
30·9 respectively.
as generally very
highest readings

7th, and 22nd
ER 1876.

Names of Stations and Observers.	Height of Station above Sea Level.	Year 1876.	Months.	Pressure of Atmosphere in Month.		Temperature of Air in Month.						Mean Temperature.	Vapour.			Mean Degree of Humidity. Sat^{n}. = 100.	Mean Weight of a cubic foot of Air.	Mean Reading of Thermometer.		Estimated Strength.	Wind.				Mean Amount of Ozone.	Mean Amount of Cloud.	Rain.	
				Mean.	Range.	Highest.	Lowest.	Range.	Mean of all Highest.	Mean of all Lowest.	Mean Daily Range.	Air.	Dew Point.	Elastic Force.	Mean.	Short of Saturation. In a cubic foot of Air.		Maximum in Rays of Sun.	Minimum on Grass.		N.	E.	S.	W.			Number of Days it fell.	Amount collected.
	feet.			in.	in.	°	°	°	°	°	°	°	°	°	in.	grs.	gr.	grs.		°								in.
SOMERLEYTON RECTORY (Suf-																												
		May		30·008	0·782	71·0	28·7	42·3	57·8	40·6	17·2	47·8	43·8	40·5	·262	3·1	0·8	84	549	109·9	39·2	1·1	11	11	9	5	—	4·4	12	1·60

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ty be stated that
841, 1842, 1855,
848, 1853, 18

th.	16th.	17th.
	°	°
5	75·0	77·5
0	84·0	78·0
0	81·0	74·0
0	72·5	78·5
8	84·1	82·8
1	90·2	85·6
1	80·0	83·2
1	78·6	84·3
1	89·5	89·0
8	78·0	86·5
7	75·4	73·4
2	89·3	85·4
9	84·0	78·6
1	86·7	84·7
7	91·0	90·3
6	85·2	84·8
8	88·2	83·5
8	87·2	85·6
8	88·2	91·2
8	91·2	86·0
8	86·1	86·0
8	88·3	86·6
8	93·0	82·5
8	88·4	86·2
8	89·0	82·4
8	86·0	88·0
8	74·0	80·0
8	76·2	80·0
8	83·1	81·0
8	85·2	84·2
8	83·8	81·6
8	80·7	83·2
8	87·4	88·7
8	85·8	81·0
8	81·0	75·0
8	71·8	69·0
8	80·6	82·0
8	84·0	85·0
8	82·8	82·7
8	78·1	75·5
8	74·0	70·0
8	79·1	77·1
8	79·0	77·0
8	86·0	82·0
8	82·3	83·3
8	81·3	76·1
8	82·0	68·0
8	83·8	77·0
8	80·0	75·0
8	75·0	—
8	67·3	64·0
8	76·0	75·0

0

1860, 1862, 1865, and 1866, in which the temperature was not so high as 80°; and the instances in which it was about 90°, or higher, are as follows:—

July	1843	it was	89°·8	August	1842	it was	90°·5
„	1846	„	93°·3	„	1846	„	92°·0
„	1847	„	89°·0	„	1847	„	87°·3
„	1852	„	90°·3	„	1856	„	89°·8
„	1854	„	88°·7	„	1857	„	88°·0
„	1857	„	89°·7	„	1859	„	91°·3
„	1859	„	93°·0	„	1861	„	89°·3
„	1868	„	96°·6	„	1864	„	88°·6
„	1869	„	90°·9	„	1867	„	89°·0
„	1870	„	89°·7	„	1868	„	90°·5
„	1872	„	90°·9	„	1869	„	89°·0
„	1873	„	88°·7	„	1871	„	89°·2
„	1874	„	92°·0	„	1873	„	87°·3

Showing that the days of extreme high temperature about London have been more numerous than usual, and from the preceding table it would seem to have been general. The few days following July 22nd were of moderate temperature, and but little rain fell. Scarcely any rain fell in August till after the middle of the month, and the average excess of mean temperature for the 53 days ending August 22nd was 4°½ daily. A complete change of weather set in on August 23rd, and rain fell very continuously. The temperature was low till September 17th, the average daily deficiency being 3°½; from September 18th to the end of the quarter it was warm, there being an average excess of daily temperature amounting to 2°½, but rain fell almost on every day and the weather was bad.

The readings of the barometer at 160 feet above the level of the sea, in the vicinity of London, were alternately above and below their respective averages, from the 1st to the 8th of July; they were above their averages from the 9th to the end of the month, with the exception of three days, viz., 23rd, 28th, and 31st, which were 0·03 in., 0·25 in., and 0·22 in. respectively below their averages. The greatest departure in excess of the average was 0·42 in. on the 12th, and the greatest in defect was 0·25 in. on the 28th. From the 1st to the 13th of August the readings of the barometer were above their average values, with the exception of the 3rd, which was 0·30 in. below; the readings were alternately above and below their averages from the 14th to the 18th; and from the 19th to the end of the month the readings were all below their averages, that for the last day being 0·87 in. in defect. During the first 18 days of September the readings of the barometer were all below their average values, to the mean amount of 0·30 in.; they were above from the 19th to the 22nd, to the mean amount of 0·23 in., and from the 23rd to the end of the month the readings were again below their averages, to the mean amount of 0·26 in. The mean reading for the month was 29·620 ins., being 0·187 in. below the average. In the preceding 35 years there are only 2 instances of so low a barometer reading for the month of September as in the present year, viz.:—

In 1841 the mean reading was 29·624 ins., and in 1860 was 29·575 ins.

At Greenwich *the mean temperature of the air* for July was 7°·4 above that of June; that of August was 2°·2 below that of July; and that of September was 7°·9 below that of August. (From the preceding 35 years' observations the *mean temperature* of July above that of June is 3°·2; that of August below that of July is 0°·7; and that of September below that of August is 4°·1.)

The mean temperature of the air for July above that of June; South of latitude 52° was 6°·7; and North of 52° was 5°·4; that of August below that of July over the whole country was 1°·8; and that of September below that of August, over the whole country was 6°·2.

The mean temperature of the air for July was 65°·9, being 4°·3 and 3°·8 above the averages of the preceding 105 years, and 35 years respectively; it was higher than any previous value back to 1841, with the exception of the year 1859 which was 68°·1, and the year 1868 which was 67°·5.

The mean temperature of the air for August was 63°·7, being 2°·9 and 2°·3 above the averages of the preceding 105 years, and 35 years respectively; it was 3°·4 and 0°·7 above the values in 1874 and 1875 respectively.

The mean temperature of the air for September was 55°·8, being 0°·8 and 1°5 below the averages of the preceding 105 years, and 35 years respectively; it was 2°·1 and 4°·2 below the values in 1874 and 1875 respectively, but 1°·1 above that in 1873.

The mean temperature of the air for the quarter was 61°·8, being 2°·1 and 1°·5 above the averages of the preceding 105 years, and 35 years respectively.

The mean high day temperatures of the air were 5°·7 and 3°·8 above their respective averages in July and August; but 2°·0 below in September.

The mean low night temperatures of the air were 2°·0 and 0°·3 above their respective averages in July and August; but 0°·6 below in September.

Therefore the days and nights in July and August were warm, but somewhat cold in September.

The mean daily ranges of temperature were 3°·7 and 3°·6 greater than their respective averages in July and August; but 1°·4 less in September.

At Greenwich the increase of atmospheric pressure from June to July was 0·086 in., the decrease from July to August was 0·134 in., and the decrease from August to September was 0·148 in. Over the whole country the mean increase from June to July was 0·102 in. south of latitude 51°; between latitudes 51° and 52° was 0·087 in.; between 53° and 54° was 0·073 in.; between 54° and 55° was 0·063 in. and north of 55° was 0·058 in. The decrease of pressure from *July to August* was very nearly the same everywhere; its mean from all stations was 0·128 in.; *and the decrease from* August to September was nearly of the same value south of 55°, viz., *0·160 in.; and north of* the parallel it was 0·129 in.

At Greenwich the fall of rain in July was 0·7 in., being 1·9 in. below its average; in August was 2·0 in., being 0·4 in. below its average; and in September was 2·6 in., being 0·1 in. above its average. The total fall in the quarter was 5·3 in., being 2·2 in. below the average. The following are the only instances back to 1815, when the fall of rain in the 3 months ending September 30th, was so small as that in the present year, viz.:—1815 it was 4·8 in.; 1818 it was 5·1 in.; 1832 it was 4·5 in.; 1833 it was 5·3 in.; 1847 it was 4·3 in.; 1854 it was 5·3 in.; 1861 it was 4·1 in.; 1864 it was 4·5 in.; 1868 it was 5·2 in.; and 1869 it was 4·9 in.

The average duration of the different directions of the wind referred to eight points of the compass, and the duration of each direction in each month in the quarter, were as follows:—

Direction of Wind.	July.			August.			September.		
	Average.	1876.	Departure from Average.	Average.	1876.	Departure from Average.	Average.	1876.	Departure from Average.
	d.	d.	d.	d.	d.	d.	d.	d.	d.
N.W.	2½	2	− ½	2	2	0	1½	6	+4½
N.	3½	5	+1½	3	3	0	3½	3	− ½
N.E.	3½	2	−1½	3	2	−1	5½	0	−5½
E.	1½	2	+ ½	1½	6	+4½	1½	2	+ ½
S.E.	½	1	+ ½	1¼	2	+ ¾	1¼	3	+1¾
S.	2½	2	− ½	3	3	0	2	4	+2
S.W.	10½	8	−2½	10½	10	− ½	7½	7	− ½
W.	4	8	+4	3¼	3	+ ¼	2½	3	+ ½
Calm (nearly.)	2½	1	−1½	3½	0	−3½	4½	2	−2½

The sign + denotes excesses over averages; in the month of July the largest number with this sign is opposite to W., in August to E., and in September to N.W.

The sign − denotes defects below averages; in July the largest number with this sign is opposite to S.W.; in August to E., but the number is small; and in September to N.E.

1876. Months.	Temperature of Air.			Temperature of Evaporation.		Temperature of Dew Point.		Air—Daily Range.		Water of the Thames.	Elastic Force of Vapour.		Weight of Vapour in a Cubic Foot of Air.	
	Mean.	Diff. from average of 105 years.	Diff. from average of 35 years.	Mean.	Diff. from average of 35 years.	Mean.	Diff. from average of 35 years.	Mean.	Diff. from average of 35 years.		Mean.	Diff. from average of 35 years.	Mean.	Diff. from average of 35 years.
	°	°	°	°	°	°	°	°	°	°	in.	in.	grs.	gr.
July -	65·9	+4·3	+3·8	60·2	+2·5	55·5	+1·6	24·9	+3·7	68·0	0·442	+0·025	4·9	+0·3
August	63·7	+2·9	+2·2	58·2	+0·8	53·6	−0·2	23·4	+3·6	67·2	0·412	−0·004	4·6	0·0
Sept. -	55·8	−0·8	−1·5	52·9	−1·2	50·2	−1·0	17·1	−1·4	59·3	0·365	−0·016	4·1	−0·1
Means -	61·8	+2·1	+1·5	57·1	+0·7	53·1	+0·1	21·8	+2·0	64·8	0·406	+0·002	4·5	+0·1

1876. Months.	Degree of Humidity.		Reading of Barometer.		Weight of a Cubic Foot of Air.		Rain.		Daily Horizontal movement of the Air.	Reading of Thermometer on Grass.				
										Number of Nights it was			Lowest Reading at Night.	Highest Reading at Night.
	Mean.	Diff. from average of 35 years.	Mean.	Diff. from average of 35 years.	Mean.	Diff. from average of 35 years.	Amount.	Diff. from average of 61 years.		At or below 30°.	Between 30° and 40°.	Above 40°.		
			in.	in.	grs.	grs.	in.	in.	Miles.				°	°
July -	69	−6	29·902	+0·100	526	−2	0·7	−1·9	240	0	1	30	38·6	58·0
August	70	−7	29·768	−0·027	526	−3	2·0	−0·4	263	0	3	28	34·1	59·7
Sept. -	82	+1	29·620	−0·187	532	−1	2·6	+0·1	272	0	7	23	36·5	53·0
Means -	74	−4	29·763	−0·038	528	−2	Sum 5·3	Sum −2·2	Mean 2·8	Sum 0	Sum 11	Sum 81	Lowest 34·1	Highest 59·7

Note.—In reading this table it will be borne in mind that the minus sign (−) signifies *below* the average, and that the plus sign (+) signifies *above* the average.

Thunderstorms occurred or Thunder was heard and Lightning seen in July on the 8th, at Somerleyton, Norwich, and Halifax; on the 16th in the valley of the Trent, at Ross and Hereford; on the 22nd at many places in the Midland Counties; on the 23rd at many places between latitudes 51° and 55°; on this day there was a very destructive storm north of London, accompanied with large hailstones, and the damage done was very great; at Tottenham some houses, and many conservatories had nearly every pane of glass broken, on the side facing the storm, and trees were nearly stripped of leaves; on the 28th and 31st storms occurred at different places widely separated. In August, on the 1st at Holkham, Halifax, and Hull; on the 15th, 16th, 17th, 18th, 19th, and 20th, at stations south of latitude 52°; at Bristol, on the 19th, during a heavy thunderstorm, rain fell to the depth of 3·57 in.; on the 24th, 26th, 30th, and 31st, at stations mostly north of latitude 52°, but none of these storms were very heavy. In September, on the 3rd, 4th, 5th, 6th, 7th, 8th, and 9th, at stations mostly south of London; on the 15th at Ramsgate; on the 17th and 18th at London and stations north; on the 22nd, 23rd, and 24th, at stations north of 52°; on the 28th at Royston, and 29th at Helston.

MONTHLY METEOROLOGICAL TABLE FOR THE QUARTER ENDING SEPTEMBER 30TH, 1876.

The Observations have been reduced to Mean values by Glaisher's Barometrical and Diurnal Range Tables, and the Hygrometrical results have been deduced from the fifth edition of his Hygrometrical Tables.

Names of Stations and Observers.	Height of Station above Sea Level.	Year 1876. Months.	Pressure of Atmosphere in Month. Mean.	Pressure of Atmosphere in Month. Range.	Temperature of Air in Month. Highest.	Lowest.	Range.	Mean of all Highest.	Mean of all Lowest.	Mean Daily Range.	Mean Temperature. Air.	Dew Point.	Vapour. Elastic Force.	Vapour. In a cubic foot of Air. Mean.	Vapour. In a cubic foot of Air. Short of Saturation.	Mean Degree of Humidity. Sat. = 100.	Mean Weight of a cubic foot of Air.	Mean Reading of Thermometer. Maximum in Rays of Sun.	Mean Reading of Thermometer. Minimum on Grass.	Wind. Estimated Strength.	Wind. Relative Proportion of N.	E.	S.	W.	Mean Amount of Ozone.	Mean Amount of Cloud.	Rain. Number of Days it fell.	Rain. Amount collected.
	feet.		in.	in.	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°									in.
GUERNSEY, Samuel Elliott Hoskins, Esq., M.D., F.R.S., F.M.S.	204	July	29·909	0·676	79·0	51·0	28·0	69·2	57·0	12·2	61·5	56·1	·451	5·0	1·1	83	530	—	—	1·2	8	6	7	10	8·2	3·3	5	0·46
		Aug.	29·772	1·000	77·5	51·6	26·5	67·9	56·9	11·0	60·7	56·4	·455	5·1	0·9	86	529	—	—	1·3	8	5	8	10	3·8	3·3	13	3·36
		Sept.	29·625	1·190	68·0	46·0	22·0	62·5	54·1	8·4	56·8	54·5	·426	4·7	0·5	92	530	—	—	1·7	4	3	11	12	4·1	5·3	22	3·37
HELSTON (Cornwall), Matthew P. Moyle, Esq., M.R.C.S.	106	July	29·990	0·676	91·0	46·0	48·0	76·5	54·2	22·3	63·8	53·9	·417	4·6	1·9	71	530	146·4	52·4	2·0	7	7	9	8	3·8	4·5	9	1·11
		Aug.	29·906	0·820	84·0	45·0	39·0	72·8	51·4	18·4	61·8	49·3	·352	3·9	2·2	64	531	88·5	49·6	1·9	7	4	9	11	4·2	3·6	12	3·66
		Sept.	29·736	1·252	72·0	42·0	30·0	65·0	48·5	16·5	56·0	47·3	·329	3·7	1·3	73	534	75·9	45·9	2·1	7	4	8	11	7·2	6·7	19	4·91
TRURO (Cornwall), C. Barham, Esq., M.D., F.M.S.	43	July	30·040	0·699	86·0	39·0	47·0	73·5	55·3	18·2	62·7	53·7	·413	4·6	1·8	73	532	—	—	2·2	7	7	7	10	—	5·3	10	0·83
		Aug.	29·904	0·919	81·0	48·0	33·0	71·3	55·9	15·4	61·3	53·3	·406	4·5	1·5	75	530	—	—	2·5	8	6	6	11	—	5·4	14	4·57
		Sept.	29·744	1·198	69·0	44·0	25·0	63·8	52·8	11·0	56·4	51·9	·388	4·3	0·8	85	533	—	—	2·7	7	4	6	13	—	6·8	25	5·37
PLYMOUTH (Devon), John Merrifield, Esq., F.R.A.S., F.M.S., LL.D.	69	July	30·117	0·735	84·0	46·0	38·0	72·2	57·6	14·6	63·6	57·0	·466	5·1	1·4	79	532	—	55·2	2·2	9	6	4	12	—	5·1	8	1·24
		Aug.	29·968	1·024	78·5	48·0	30·5	70·0	56·5	13·5	62·2	56·6	·460	5·2	1·1	82	530	—	54·2	1·6	8	8	4	11	—	6·0	12	4·37
		Sept.	29·817	1·279	67·5	44·0	23·5	63·0	51·0	12·0	55·7	53·2	·402	4·6	0·4	91	535	—	49·3	1·3	6	6	5	13	—	6·8	21	5·11
VENTNOR (Royal National Hospital), Isle of Wight. Hartley Sagar, Esq.	100	Jan.	30·235	0·793	55·4	26·1	29·3	45·9	35·8	10·1	40·0	37·2	·322	2·6	0·3	90	561	—	—	—	—	—	—	—	7·0	—	9	0·55
		Feb.	29·712	0·836	54·5	30·6	23·9	49·1	39·5	9·6	43·0	40·1	·249	2·8	0·4	90	548	—	—	—	—	—	—	—	7·4	—	19	3·38
		Mar.	29·626	1·311	57·8	28·9	28·9	50·9	38·0	12·9	43·1	38·5	·233	2·7	0·5	83	546	—	—	—	—	—	—	—	7·1	—	19	3·54
		April	29·834	1·479	66·0	32·5	33·5	57·4	42·8	14·6	48·0	43·8	·285	3·3	0·5	86	544	—	—	—	—	—	—	—	6·9	—	14	1·52
		May	30·106	0·717	72·4	35·1	37·3	62·7	44·2	18·5	51·3	43·2	·280	3·2	1·1	74	546	—	—	—	—	—	—	—	6·6	—	3	0·29
		June	29·989	0·498	80·7	44·3	36·4	68·8	52·3	16·5	58·2	50·8	·373	4·2	1·3	77	536	—	—	—	—	—	—	—	7·6	—	9	0·81
		July	30·082	0·699	90·1	52·3	37·8	74·6	58·3	16·3	64·4	56·6	·458	5·0	1·7	75	530	—	—	—	—	—	—	—	7·3	—	6	0·84
		Aug.	29·959	1·122	84·1	46·1	38·0	73·9	56·9	17·0	63·5	55·6	·443	4·9	1·5	76	529	—	—	—	—	—	—	—	7·6	—	11	4·03
		Sept.	29·813	0·936	72·8	41·1	31·7	67·3	53·2	14·1	58·8	53·5	·410	4·5	1·0	82	531	—	—	—	—	—	—	—	8·2	—	19	4·26
OSBORNE (Isle of Wight), J. R. Mann, Esq.	172	July	29·912	0·748	93·9	47·8	46·1	78·5	56·1	22·4	66·0	61·1	·540	5·9	1·1	85	525	134·0	51·6	0·2	5	3	8	15	—	4·2	4	0·39
		Aug.	29·776	1·150	92·3	44·9	47·4	75·2	54·7	20·5	63·7	56·4	·456	5·0	1·5	78	526	129·7	49·6	0·2	5	7	7	12	—	4·0	13	3·02
		Sept.	29·617	1·082	74·2	42·0	32·2	66·2	50·9	15·3	57·0	54·7	·430	4·7	0·5	91	530	119·6	45·7	0·2	3	3	10	14	—	6·5	20	4·14
SOUTH BOURNE, (near) Bournemouth (Hants), T. A. Compton, Esq., M.D., B.A., F.M.S.	128	July	29·998	0·760	87·6	49·0	38·6	71·9	56·7	15·2	63·2	52·1	·390	4·4	2·1	67	531	—	—	—	10	2	6	13	—	2·4	7	0·46
		Aug.	29·851	1·120	84·1	42·8	41·3	69·9	54·8	15·1	61·6	51·2	·376	4·1	1·9	69	530	—	—	—	7	6	4	14	—	1·8	10	3·84
		Sept.	29·683	0·970	67·3	44·0	23·3	63·9	51·5	12·4	57·0	50·8	·372	4·1	1·1	79	531	—	—	—	3	3	5	19	—	3·7	21	4·20
BRIGHTON (Sussex), F. E. Sawyer, Esq., F.M.S.	206	Apr.	29·652	1·587	66·0	29·7	36·3	55·0	42·0	13·0	47·7	41·7	·264	3·1	0·7	80	541	96·2	37·6	0·9	6	5	12	7	—	5·8	14	1·88
		May	29·897	0·836	65·6	33·1	33·5	56·3	42·2	14·1	48·5	39·3	·243	2·8	1·1	71	546	104·7	39·6	1·3	12	8	5	6	—	6·0	6	0·98
		June	29·778	0·563	77·8	41·0	36·8	66·6	51·4	15·2	58·2	48·3	·340	3·8	1·7	70	532	113·0	50·1	0·9	4	7	10	9	—	6·3	9	2·65
		July	29·850	0·738	79·2	49·6	29·6	71·8	57·1	14·7	62·8	55·8	·446	4·9	1·4	78	528	116·3	54·9	0·7	4	4	11	12	—	5·2	7	0·38
		Aug.	29·748	1·171	84·5	45·1	39·4	70·5	55·7	14·8	62·3	52·3	·393	4·3	1·9	70	527	116·7	52·8	1·0	6	5	9	11	—	4·2	9	4·04
		Sept.	29·586	1·165	69·0	45·6	23·4	63·9	51·5	12·4	56·7	51·3	·379	4·2	0·9	82	530	102·5	48·6	1·2	3	2	9	16	—	7·2	19	4·42
HASTINGS (Sussex), Alex. E. Murray, Esq., F.M.S.	167	July	29·918	0·756	81·2	49·5	31·7	70·4	55·8	14·6	62·0	54·2	·421	4·6	1·6	76	530	—	52·8	1·5	7	5	7	12	—	5·4	7	0·44
		Aug.	29·775	1·182	86·1	44·1	42·0	70·4	55·3	15·1	62·1	53·4	·409	4·5	1·7	74	528	—	51·9	1·8	9	5	7	10	—	4·1	14	3·37
		Sept.	29·637	1·137	67·6	43·1	24·5	63·1	50·9	12·2	56·2	50·6	·369	4·2	0·9	82	531	—	46·4	1·7	3	3	8	16	—	5·7	19	3·68
TAUNTON (Somerset), James Bottomley, Esq.	80	Sept.	29·724	1·318	72·0	42·0	30·0	64·8	51·3	13·5	57·0	53·2	·405	4·5	0·7	87	532	76·8	47·2	0·2	6	2	7	15	2·5	6·2	25	5·36
SALISBURY (Wilton House), T. Challis, Esq.	186	July	—	—	93·0	42·5	50·5	79·7	52·3	27·4	64·3	57·4	·472	5·2	1·4	78	—	131·8	49·2	1·7	8	3	2	18	—	5·4	5	0·37
		Aug.	29·740	1·196	93·0	37·6	55·6	76·8	50·2	26·1	62·2	53·3	·408	4·5	1·7	73	527	124·3	47·6	1·6	7	3	2	19	—	4·6	11	2·45
		Sept.	29·573	1·194	78·0	38·5	39·5	67·0	47·3	19·7	56·1	50·1	·364	4·1	0·9	80	530	104·3	44·2	1·6	7	1	6	16	—	6·6	18	5·06

Names of Stations and Observers.	Height of Station above Sea Level.	Year 1876.	Pressure of Atmosphere in Month.		Temperature of Air in Month.						Mean Temperature.		Vapour.			Mean Degree of Humidity. Sat.=100.	Mean Weight of a cubic foot of Air.	Mean Reading of Thermometer.		Wind.					Amount of Ozone.	Amount of Cloud.	Rain.	
								Mean					Elastic Force.	In a Cubic foot of Air.				Maximum in Rays of Sun.	Minimum on Grass.	Estimated Strength.	Relative Proportion of						Number of Days it fell.	Amount collected.
	Height of Station above Sea Level.	Months.	Mean.	Range.	Highest.	Lowest.	Range.	Of all Highest.	Of all Lowest.	Daily Range.	Air.	Dew Point.		Mean.	Amount of Saturation.						N.	E.	S.	W.				
	feet.		in.	in.	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°									in.
BARNSTAPLE (Devon), T. Mackrell, Esq.	43	July	30·050	0·760	94·0	47·5	46·5	72·9	59·1	13·8	65·7	54·6	·428	4·7	2·2	68	529			1·2	4	2	13	12	—	8·2	10	1·37
		Aug.	29·908	1·086	89·0	50·0	39·0	74·3	59·4	14·9	64·2	55·6	·443	5·0	1·7	74	528	—	—	1·4	4	7	9	11	—	4·4	13	2·74
		Sept.	29·750	1·190	74·0	49·0	25·0	65·5	54·6	10·9	58·4	53·8	·415	4·6	0·9	85	531	—	—	1·5	5	2	8	15	—	3·9	24	5·77
CATERHAM (Surrey), James Adam, Esq., M.D.	660	July	29·440	0·800	—	45·0	—	—	55·1	—	—	—	—	—	—	—	—	85·1	—	1·7	8	4	6	13	0·3	2·1	8	0·75
		Aug.	29·304	1·150	—	42·0	—	—	52·5	—	—	—	—	—	—	—	—	83·8	—	1·5	7	5	7	12	0·6	2·6	11	3·38
		Sept.	29·156	1·050	—	40·0	—	—	48·8	—	—	—	—	—	—	—	—	71·1	—	2·2	8	1	6	15	0·3	4·0	24	4·50
RAMSGATE (St. Augustine's Monastery), Rev. T. Hugh Quelch, O.S.B.	108	July	29·983	0·803	85·7	49·7	36·0	72·1	57·4	14·7	61·3	56·4	·457	5·1	1·4	79	530	121·6	54·4	1·7	7	8	9	7	—	6·0	5	0·38
		Aug.	29·844	1·184	79·9	43·1	36·8	70·6	56·9	13·7	62·7	55·8	·447	5·0	1·4	78	528	119·3	52·0	1·9	9	7	8	7	—	4·4	12	1·70
		Sept.	29·697	1·044	69·5	43·5	26·0	63·6	51·4	12·2	56·8	51·4	·380	4·2	0·9	82	532	105·3	44·3	1·7	6	2	13	9	—	5·9	15	2·93
STRATHFIELD TURGISS (Hants), Rev. C. H. Griffith, M.A., F.M.S.	197	July	29·881	0·768	91·2	43·0	48·2	77·0	54·2	22·8	64·5	54·6	·427	4·7	1·9	70	527	128·0	51·2	0·6	9	4	7	11	3·5	4·4	6	1·28
		Aug.	29·760	1·138	94·5	40·8	53·7	74·9	54·9	20·0	63·2	53·8	·415	4·6	1·8	72	526	117·6	50·7	0·6	7	7	4	13	3·5	4·0	10	2·87
		Sept.	29·596	1·044	71·2	38·2	33·0	64·4	48·3	16·1	55·7	51·0	·374	4·2	0·7	85	531	110·5	43·4	0·6	9	5	5	11	3·0	5·9	21	4·19
WEYBRIDGE HEATH (Surrey), William F. Harrison, Esq., F.M.S.	150	Sept.	29·654	1·133	72·8	39·5	33·3	65·8	47·1	18·7	55·6	50·7	·370	4·2	0·8	85	532	101·7	46·4	0·7	3	2	16	9	0·9	5·5	23	2·57
EAST TILBURY Vicarage (Essex), Rev. R. Tyas, M.A., LL.D.	29	July	30·061	0·724	95·5	42·0	53·5	83·9	56·7	27·2	67·4	59·9	·514	5·6	1·8	77	526	126·6	51·0	0·4	7	5	10	9	—	4·9	5	0·33
		Aug.	29·916	1·216	96·0	40·0	56·0	78·7	53·7	25·0	64·8	55·1	·435	4·8	2·0	71	527	115·2	50·6	0·3	4	10	7	10	—	4·8	9	1·05
		Sept.	29·766	0·896	75·0	39 9	35·1	67·5	49·3	18·2	57·7	53·0	·401	4·5	0·5	84	532	89·3	45·4	0·1	0	1	10	19	—	7·2	22	1·84
MARLBOROUGH, The Green (Wilts), Rev. Thomas A. Preston, M.A., F.M.S.	474	July	29·587	0·750	90·7	48·8	41·9	73·9	54·6	21·3	64·0	56·5	·457	5·1	1·5	77	522	126·3	50·7	0·1	7	4	8	12	—	4·6	7	0·57
		Aug.	29·440	1·188	92·0	39·8	52·2	72·9	52·0	20·9	61·3	54·4	·424	4·7	1·4	79	522	122·3	48·0	0·2	8	4	6	13	—	4·9	12	4·67
		Sept.	29·288	1·131	71·5	40·8	30·7	63·8	48·7	15·1	55·3	51·4	·379	4·2	0·7	87	526	108·1	45·1	0·2	7	3	4	16	—	7·1	24	6·38
BECKENHAM (Kent), C. O. F. Cator, Esq., M.A., F.M.S.	170	July	29·914	0·823	94·1	39·5	54·6	80·4	53·2	27·2	64·6	56·2	·453	5·0	1·7	74	527	—	—	—	6	5	6	14	—	—	6	0·33
		Aug.	29·783	1·213	96·1	38·2	57·9	76·9	51·2	25·7	62·3	54·9	·432	4·8	1·5	77	527	—	—	—	4	9	7	11	—	—	10	2·43
		Sept.	29·604	1·111	75·1	38·0	37·1	66·9	46·3	20·6	55·5	50·7	·370	4·2	0·8	85	531	—	—	—	5	4	8	13	—	—	25	2·52
BLACKHEATH (London), James Glaisher, Esq., F.R.S.	160	July	29·897	0·800	90·3	45·2	44·4	77·7	56·1	21·6	65·0	54·6	·427	4·7	2·1	70	527	119·2	53·3	1·1	5	2	10	14	—	4·7	7	0·72
		Aug.	29·768	1·250	89·6	42·1	47·5	74·5	54·2	20·3	62·9	53·7	·413	4·6	1·8	72	527	115·4	52·1	1·3	7	7	9	8	—	4·7	13	2·02
		Sept.	29·613	1·086	72·1	41·9	30·2	65·3	48·9	16·4	55·8	49·6	·357	4·0	1·0	81	531	98·7	46·0	1·1	6	5	8	11	—	5·9	22	2·73
STREATLEY VICARAGE (Berks), Rev. J. Slatter, M.A., F.R.A.S., F.M.S.	150	July	29·923	0·774	93·4	43·8	49·6	79·3	55·2	24·1	65·2	56·6	·460	5·1	1·8	75	527	—	—	1·8	9	3	6	13	—	4·6	9	1·23
		Aug.	29·788	1·170	95·3	40·7	54·6	75·7	53·5	22·2	62·7	55·2	·435	4·9	1·4	77	527	—	—	1·3	9	5	6	11	—	4·1	11	5·04
		Sept.	29·628	1·086	72·2	39·4	32·8	65·1	50·5	14·6	56·6	51·6	·383	4·3	0·8	83	531	—	—	1·8	8	5	6	11	—	5·3	24	5·27
CHISWICK (Middlesex), J. K. L. M. Farquhar, Esq.	25	July	30·050	0·808	93·0	40·2	52·8	79·1	53·8	25·3	65·1	57·1	·469	5·1	1·6	76	529	127·1	48·7	0·6	3	5	8	15	—	6·1	5	0·80
		Aug.	29·914	1·236	94·5	36·5	58·0	75·8	51·9	23·9	62·3	56·2	·452	5·0	1·2	80	529	122·6	46·9	0·9	5	8	6	12	—	5·2	11	1·83
		Sept.	29·751	1·052	73·5	37·0	36·5	68·4	47·4	21·0	56·0	51·2	·378	4·3	0·7	84	534	114·1	44·6	0·8	4	3	7	16	—	6·8	17	2·52
CAMDEN SQUARE (London), G. J. Symons, Esq., F.M.S.	123	July	29·950	0·794	92·6	47·3	45·3	78·7	56·7	22·0	63·8	54·9	·432	4·8	2·2	69	527	131·1	53·5	—	8	3	6	14	—	4·9	7	0·82
		Aug.	29·803	1·216	92·3	43·8	48·5	76·0	54·4	21·6	63·6	53·9	·415	4·6	1·8	71	526	126·3	50·6	—	11	1	8	11	—	4·9	19	1·79
		Sept.	29·652	1·064	71·4	41·3	30·1	65·5	49·4	16·1	56·2	51·2	·378	4·2	0·8	83	532	104·9	45·6	—	11	0	5	14	—	6·2	22	2·86
OXFORD OBSERVATORY, Rev. R. Main, M.A., F.R.S., F.R.A.S.	210	July	29·829	0·786	89·2	46·6	42·6	76·1	55·6	20·5	65·6	54·5	·426	4·7	2·2	69	525	122·8	51·6	0·6	6	2	7	16	2·4	5·5	10	0·85
		Aug.	29·690	1·195	90·3	41·5	49·0	73·2	53·3	19·9	63·0	52·7	·398	4·4	2·0	69	525	125·1	49·5	0·8	5	6	7	13	4·2	5·7	12	2·68
		Sept.	29·549	1·073	69·7	42·0	27·7	63·3	49·6	13·7	56·0	51·0	·375	4·2	0·8	83	530	111·5	47·2	0·8	5	2	8	15	1·8	7·5	20	5·59
GLOUCESTER, E. Toller, Esq., M.D.	100	July	30·009	0·830	96·0	43·0	53·0	80·8	55·7	25·1	66·0	56·1	·449	5·0	2·0	71	528	130·1	51·8	0·4	7	5	4	15	1·1	4·6	4	0·43
		Aug.	29·875	1·280	95·0	41·6	54·0	76·7	50·9	25·8	61·3	56·7	·460	5·1	1·0	85	530	119·9	47·0	0·6	9	4	4	14	2·5	5·3	7	1·60
		Sept.	29·720	1·094	76·0	40·5	35·5	66·8	48·1	18·7	56·3	53·0	·402	4·5	0·5	89	533	102·5	42·9	0·6	9	5	4	12	1·5	6·5	19	3·59
ROYSTON (Hertfordshire), Hale Wortham, Esq., F.R.A.S., F.M.S.	269	July	29·804	0·840	92·7	44·0	48·7	79·1	52·2	26·9	64·2	53·9	·414	4·7	2·0	69	526	—	—	—	7	3	7	14	—	5·3	9	0·86
		Aug.	29·683	1·166	94·8	39·6	55·2	76·3	50·8	25·5	62·4	52·2	·391	4·3	1·9	70	526	—	—	—	6	5	9	11	—	5·1	10	1·45
		Sept.	29·515	1·063	72·6	40·0	32·6	64·9	47·5	17·4	54·5	49·4	·351	4·0	0·8	82	531	—	—	—	5	4	7	14	—	6·3	18	4·43
CARDINGTON (near Bedford), Mr. MacLaren, Assistant to S. C. Whitbread, Esq., F.R.S.	105	July	29·952	0·864	91·0	43·6	47·4	78·7	55·1	23·6	66·7	53·7	·413	4·6	2·5	65	526	119·0	48·5	1·3	7	2	7	15	—	5·0	7	1·45
		Aug.	29·816	1·244	93·0	39·4	53·6	75·1	51·9	23·2	63·0	54·0	·417	4·6	1·8	73	527	111·0	45·5	1·5	3	8	5	15	—	4·4	12	2·20
		Sept.	29·663	1·050	73·0	38·0	35·0	63·8	47·8	16·0	55·0	51·5	·381	4·3	0·6	88	533	91·0	42·8	1·4	9	2	6	13	—	6·7	22	5·20

Names of Stations and Observers.	Height of Station above Sea Level.	Year 1876.	Pressure of Atmosphere in Month.		Temperature of Air in Month.						Mean Temperature.		Vapour.			Mean Degree of Humidity. Sat^{n}. = 100.	Mean Weight of a cubic foot of Air.	Mean Reading of Thermometer.		Wind.					Mean Amount of Ozone.	Mean Amount of Cloud.	Rain.	
								Mean						In a cubic foot of Air.							Relative Proportion of							
		Months.	Mean.	Range.	Highest.	Lowest.	Range.	Of all Highest.	Of all Lowest.	Daily Range.	Air.	Dew Point.	Elastic Force.	Mean.	Short of Saturation.			Maximum in Rays of Sun.	Minimum on Grass.	Estimated Strength.	N.	E.	S.	W.			Number of Days it fell.	Amount collected.
	feet.		in.	in.	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°								in.
LAMPETER (Cardiganshire), St. David's College, Prof. A. W. Scott, M.A.	420	July	29·647	0·784	90·0	32·0	58·0	74·7	48·5	26·2	61·4	53·6	·411	4·6	1·5	76	526	110·4	—	—	4	1	11	15	—	—	8	2·42
CAMBRIDGE, J. W. L. Glaisher, Esq., M.A., F.R.S.	40	July	29·994	0·866	91·2	45·0	46·2	78·4	54·9	23·5	65·3	53·1	·404	4·5	2·4	65	528	148·8	49·4	1·6	7	1	9	14	—	4·9	10	0·81
		Aug.	29·861	1·286	95·1	39·6	55·5	76·2	51·6	24·6	62·0	56·4	·456	5·1	1·1	82	529	146·0	46·5	1·6	4	7	9	11	—	4·6	15	1·60
		Sept.	29·709	1·062	72·8	37·3	35·5	65·0	48·6	16·4	55·8	50·9	·375	4·2	0·8	85	533	115·7	44·9	1·4	6	3	10	11	—	6·3	22	3·77
SOMERLEYTON RECTORY (Suffolk), Rev. C. J. Steward, F.M.S.	50	July	29·997	0·922	84·0	46·1	37·9	73·6	53·0	20·6	61·9	56·9	·462	5·1	1·1	84	531	—	45·2	1·1	7	6	9	9	6·8	4·4	7	1·92
		Aug.	29·868	1·304	87·0	43·4	43·6	72·7	52·8	19·9	61·2	53·7	·413	4·7	1·4	77	530	—	43·9	1·1	5	9	9	8	7·1	3·9	10	1·60
		Sept.	—	—	73·0	40·6	32·4	63·7	48·2	15·5	54·9	50·4	·365	4·0	0·8	83	—	—	40·1	1·1	6	4	7	13	7·6	6·6	23	5·08
NORWICH (Norfolk), John Quinton, Esq., Jun.	42	July	30·001	0·860	84·5	51·0	33·5	73·9	56·0	17·9	63·6	58·5	·492	5·5	1·1	84	530	—	—	—	7	5	9	10	—	—	3	2·07
		Aug.	29·872	1·276	87·0	42·0	45·0	72·5	54·5	18·0	62·1	55·2	·437	4·9	1·4	78	529	—	—	—	3	11	8	9	—	—	12	1·66
		Sept.	29·708	1·068	70·0	45·0	27·0	62·0	49·5	12·5	54·7	53·3	·408	4·6	0·3	95	534	—	—	—	5	4	7	14	—	—	21	4·96
LEICESTER (Town Museum), W. J. Harrison, Esq., F.G.S.	245	July	29·789	0·832	87·9	43·7	44·2	74·0	55·0	19·0	65·8	52·1	·389	4·3	2·2	66	526	130·0	48·8	0·8	5	2	9	15	—	6·0	8	0·80
		Aug.	29·656	1·279	91·9	38·0	53·9	71·7	52·2	19·5	61·5	50·7	·370	4·1	1·9	69	525	124·5	—	1·0	4	8	7	12	—	5·7	12	2·11
		Sept.	29·499	0·969	70·7	41·8	28·9	62·0	49·4	12·6	54·8	48·1	·336	3·8	1·0	78	531	106·4	42·4	1·0	5	5	7	13	—	6·7	22	5·26
WISBECH (Cambridgeshire), S. H. Miller, Esq., F.R.A.S., F.M.S.	14	July	30·034	0·936	87·7	45·3	42·4	76·8	55·0	21·8	65·3	55·5	·441	4·8	2·0	71	529	123·4	51·4	0·6	5	1	11	14	3·0	4·8	7	1·71
		Aug.	29·897	1·302	92·0	41·3	50·7	74·8	52·7	22·1	63·1	53·2	·495	4·5	1·9	70	529	119·8	48·5	0·6	7	5	8	11	3·8	4·4	13	1·82
		Sept.	29·737	1·082	70·8	41·7	29·1	63·3	48·9	14·4	54·8	52·0	·390	4·4	0·5	90	534	104·6	44·9	0·5	5	4	7	14	3·4	6·6	23	3·64
NOTTINGHAM, M. O. Talbotton, Esq., C.E., F.G.S., F.M.S.	183	June	29·766	0·548	85·8	36·5	49·3	70·7	47·7	23·0	57·7	48·4	·340	3·8	1·5	71	532	133·9	44·3	0·4	8	4	6	12	3·5	5·5	15	1·67
		July	29·833	0·816	92·2	41·3	50·9	77·8	53·3	24·5	63·8	54·2	·422	4·7	1·9	72	527	129·1	49·8	0·4	6	2	9	14	1·9	5·8	8	0·94
		Aug.	29·707	1·304	93·6	36·7	56·9	73·9	50·8	23·1	60·7	52·1	·390	4·4	1·6	73	528	119·5	47·6	0·3	6	8	7	10	2·0	5·2	17	1·71
		Sept.	29·546	0·926	73·7	36·0	37·7	63·4	47·1	16·3	54·4	48·5	·340	3·9	0·9	80	532	102·4	43·5	0·4	9	6	3	12	1·2	6·5	26	3·77
LLANDUDNO (Carnarvonshire), James Nicol, Esq., M.D., and Thomas Dalton, Esq., M.D.	100	July	29·948	0·930	86·6	48·9	37·7	70·7	55·0	15·7	61·1	53·1	·404	4·5	1·5	75	532	—	—	0·6	4	2	4	21	—	5·5	8	2·28
		Aug.	29·797	1·146	85·8	48·6	37·2	70·1	54·9	15·2	61·0	53·5	·410	4·6	1·4	77	529	—	—	0·8	4	4	6	17	—	5·6	13	2·75
		Sept.	29·654	0·900	74·6	41·5	33·1	62·5	51·1	11·4	55·8	49·6	·357	4·0	1·0	81	532	—	—	0·8	7	4	4	15	—	7·2	24	4·06
CALCETHORPE MANOR (near Louth (Lincolnshire), D. Grant Briggs, Esq., F.M.S.	382	July	29·631	0·874	83·2	43·6	39·6	70·6	52·4	18·2	59·9	54·7	·428	4·8	1·0	83	527	128·4	48·4	0·9	6	3	8	14	6·1	6·2	13	1·66
		Aug.	29·507	1·295	81·9	42·1	39·8	67·7	51·1	16·6	58·5	51·7	·383	4·3	1·2	78	527	123·8	47·4	0·8	3	10	7	11	8·4	4·9	15	3·23
		Sept.	29·344	1·010	67·8	41·9	25·9	59·5	47·3	12·2	52·3	48·3	·339	3·8	0·6	86	530	107·4	45·0	1·0	7	3	7	13	7·7	6·9	23	3·69
LIVERPOOL OBSERVATORY, John Hartnup, Esq., F.R.A.S.	197	July	29·837	0·912	84·8	50·3	34·5	68·0	55·8	12·2	60·5	50·6	·369	4·1	1·8	70	530	—	—	1·2	4	3	8	16	—	5·1	11	1·86
		Aug.	29·684	1·203	84·6	46·2	38·4	67·9	54·7	13·2	59·8	50·8	·371	4·1	1·6	72	528	—	—	1·3	3	6	6	16	—	5·2	12	3·09
		Sept.	29·536	0·964	71·0	42·0	29·0	60·1	50·3	9·8	54·2	48·7	·342	3·9	0·9	81	532	—	—	1·2	6	7	3	14	—	5·6	21	3·55
ECCLES (near Manchester), T. Mackereth, Esq., F.R.A.S., F.M.S.	145	July	29·883	0·858	93·0	41·2	51·8	72·0	51·7	20·3	60·8	52·4	·394	4·4	1·4	74	531	89·3	44·8	0·1	8	1	5	17	1·3	6·1	16	3·25
		Aug.	29·746	1·838	90·3	36·0	54·3	70·8	50·7	20·1	59·5	52·1	·389	4·4	1·3	77	530	85·4	43·9	0·4	7	4	7	13	1·5	6·8	18	3·60
		Sept.	29·595	0·920	75·6	38·9	36·7	62·5	46·7	15·8	53·8	47·7	·331	3·7	0·9	79	533	74·5	40·0	0·3	9	5	6	10	1·2	6·7	22	3·75
BERMERSIDE OBSERVATORY, HALIFAX (Yorkshire), Edward Crossley, Esq., F.R.A.S.	520	July	29·461	0·920	90·3	43·0	47·3	72·6	51·0	21·6	60·7	51·9	·387	4·3	1·6	72	523	116·2	—	0·6	3	3	10	15	—	4·6	11	1·64
		Aug.	29·351	1·362	87·3	37·4	49·9	70·1	49·6	20·5	58·4	50·1	·343	4·1	1·4	75	524	114·8	—	0·6	2	9	9	11	—	5·5	9	3·32
		Sept.	29·194	0·964	—	42·0	—	58·4	44·3	14·1	50·6	46·9	·322	3·7	0·7	88	531	95·3	—	0·4	6	7	7	10	—	6·7	21	5·05
HULL (Yorkshire), Mr. E. Peak.	12	July	29·994	0·964	87·0	46·0	41·0	73·6	54·1	19·5	62·2	55·3	·437	4·9	1·4	79	531	98·9	51·0	—	—	—	—	—	1·3	—	11	2·49
		Aug.	29·894	1·392	83·0	44·0	39·0	69·5	51·9	17·6	60·0	52·4	·393	4·4	1·4	76	532	100·0	47·3	—	—	—	—	—	2·0	—	8	1·50
		Sept.	29·716	0·980	69·0	42·0	27·0	61·4	48·9	12·5	54·5	49·5	·354	4·0	0·8	85	535	85·2	45·1	—	—	—	—	—	1·2	—	20	3·12
STONYHURST (Lancashire), Rev. S. J. Perry, F.M.S., F.R.S., F.R.A.S.	363	July	29·656	0·908	87·2	42·1	45·1	70·3	52·2	18·1	59·8	53·4	·409	4·6	1·2	80	527	127·4	50·6	—	1	1	8	21	—	6·5	14	5·32
		Aug.	29·498	1·581	84·1	38·1	46·0	68·8	51·2	17·6	59·7	53·1	·404	4·5	1·2	80	525	123·5	49·6	—	7	6	6	13	—	6·1	18	4·31
		Sept.	29·347	0·944	72·4	39·5	32·9	63·8	49·5	14·3	55·5	46·9	·323	3·6	1·1	74	527	111·8	44·9	—	9	6	3	12	—	7·4	23	5·28
LEEDS (Philosophical Hall) (Yorkshire), Louis C. Miall, Esq.	137	July	29·858	1·002	92·0	47·0	45·0	76·5	55·9	20·6	64·8	56·8	·462	5·1	1·7	74	526	100·8	—	1·3	4	4	7	16	—	3·5	11	1·78
		Aug.	29·746	1·628	94·0	43·0	51·0	79·1	53·1	26·0	63·5	54·2	·430	4·6	1·7	74	527	102·0	—	1·5	4	9	8	13	—	4·3	9	1·80
		Sept.	29·586	0·964	73·0	43·0	30·0	62·7	48·6	14·1	54·6	51·4	·390	4·3	0·5	89	532	87·1	—	1·5	6	7	7	10	—	5·1	20	3·18

Names of Stations and Observers.	Height of Station above Sea Level.	Year 1876.	Pressure of Atmosphere in Month.		Temperature of Air in Month.						Mean Temperature.		Vapour.			Mean Degree of Humidity. Sat. = 100.	Mean Weight of a cubic foot of Air.	Mean Reading of Thermometer.		Wind.				Mean Amount of Ozone.	Mean Amount of Cloud.	Rain.	
								Mean						In a cubic foot of Air.						Relative Proportion of							
		Months.	Mean.	Range.	Highest.	Lowest.	Range.	Of all Highest.	Of all Lowest.	Daily Range.	Air.	Dew Point.	Elastic Force.	Mean.	Short of Saturation.			Maximum in Rays of Sun.	Minimum on Grass.	Estimated Strength.	N.	E.	S.	W.			Number of Days it fell.	Amount collected.
	feet.		in.	in.	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°								in.
BRADFORD (Yorkshire), J. McLandsborough, Esq., C.E., F.G.S.	366	July	29·645	0·958	87·6	48·1	39·5	71·4	55·9	15·5	62·2	49·0	·348	3·9	2·2	62	526	104·1	—	0·6	5	4	3	19	—	5·4	13	1·33
		Aug.	29·503	1·353	83·6	44·0	39·6	68·6	53·6	15·0	59·4	48·7	·343	3·9	1·8	68	526	93·2	—	0·7	3	7	4	17	—	4·9	13	2·78
		Sept.	29·361	0·949	66·4	44·2	22·2	59·3	49·2	10·1	53·2	46·4	·315	3·6	1·2	78	530	76·7	—	1·1	8	7	2	13	—	7·5	21	2·91
COCKERMOUTH (Cumberland), H. Dodgson, Esq., M.D., F.R.A.S., F.M.S.	146	July	29·839	0·968	85·4	44·6	40·8	68·6	52·8	15·8	59·3	49·3	·351	3·9	1·7	69	532	113·1	45·4	0·5	4	2	10	15	1·5	6·0	13	2·25
		Aug.	29·690	1·369	88·3	43·6	44·7	68·7	51·7	17·0	59·0	50·8	·372	4·1	1·4	75	530	108·3	44·2	0·3	4	8	8	11	1·9	4·9	12	3·82
		Sept.	29·572	0·954	74·5	37·8	36·7	60·9	47·7	13·2	53·6	47·5	·327	3·6	0·9	80	533	92·8	39·3	0·2	8	3	7	12	1·5	6·8	22	4·59
ALLENHEADS (Northumberland), Mr. T. Kidd, Assistant to W. B. Beaumont, Esq., M.P.	1360	July	28·618	0·991	—	43·0	—	—	48·8	—	—	—	—	—	—	—	—	124·5	45·4	1·3	5	5	6	15	—	5·8	16	2·04
		Aug.	28·483	1·306	—	33·0	—	—	48·2	—	—	—	—	—	—	—	—	117·4	43·9	1·1	4	5	11	11	—	5·1	13	3·26
		Sept.	28·337	0·992	—	37·0	—	—	43·7	—	—	—	—	—	—	—	—	92·8	39·9	0·8	7	4	8	11	—	6·7	26	5·42
SILLOTH RECTORY (Cumberland), Rev. Francis Redford., M.A., F.R.A.S., F.M.S.	28	July	29·967	0·981	85·7	42·9	42·8	73·3	51·4	21·9	60·4	52·9	·402	4·5	1·4	77	533	108·0	48·4	1·5	3	3	11	14	6·5	4·7	13	2·02
		Aug.	29·854	1·389	88·5	37·4	51·1	73·9	50·8	23·1	60·2	53·7	·412	4·6	1·2	79	531	109·0	47·3	1·5	4	8	9	10	8·8	3·6	12	3·88
		Sept.	29·707	1·039	77·2	39·0	38·2	65·6	47·0	18·6	54·8	48·9	·346	4·0	0·9	80	534	99·4	43·1	1·4	5	5	9	11	5·5	5·5	18	3·52
CARLISLE (Cumberland), Isaac Cartmell, Esq., F.M.S.	114	July	29·865	0·988	85·5	42·4	43·1	70·0	50·2	19·8	59·9	52·2	·392	4·4	1·1	76	532	107·0	45·4	1·8	2	2	6	21	5·3	5·9	15	2·59
		Aug.	29·730	1·302	91·2	36·5	54·7	79·3	48·3	22·0	60·1	49·8	·358	3·9	1·8	69	529	108·9	43·3	1·9	4	6	7	14	5·4	5·6	13	2·92
		Sept.	29·611	1·084	78·0	35·9	42·1	62·0	45·5	16·5	53·0	47·0	·322	3·6	0·9	80	534	93·6	40·3	1·3	8	7	5	10	4·5	6·9	23	3·14
BYWELL (Northumberland), Mr. John Dawson, Assistant to W. B. Beaumont, Esq., M.P.	87	July	29·846	1·036	87·0	31·0	36·0	72·4	56·6	15·8	62·1	52·6	·398	4·4	1·8	71	529	101·3	31·1	1·3	9	4	3	15	—	3·8	11	1·82
		Aug.	29·737	1·482	85·0	37·0	48·0	71·2	53·3	17·9	59·6	50·9	·373	4·2	1·5	73	530	102·5	47·7	1·2	10	4	3	14	—	3·4	7	2·01
		Sept.	29·602	1·072	70·0	43·0	27·0	62·1	49·3	12·8	51·6	49·3	·354	4·0	0·6	86	534	77·7	43·7	1·1	5	6	4	15	—	5·8	26	3·67
NORTH SHIELDS (Northumberland), Robert Spence, Esq.	124	July	29·923	0·993	82·5	47·5	35·0	66·9	54·2	12·7	59·0	50·6	·369	4·2	1·4	74	533	—	52·8	1·3	7	4	5	15	—	5·9	15	2·74
		Aug.	29·803	1·383	71·8	39·6	32·2	61·9	51·1	10·8	56·1	48·7	·346	3·9	1·1	78	535	—	50·2	1·5	8	6	7	10	—	4·6	10	1·28
		Sept.	29·670	1·187	64·0	41·0	23·0	57·2	48·0	9·2	52·0	46·7	·320	3·6	0·8	82	537	—	47·0	1·8	10	6	4	10	—	7·8	23	2·74
MILLTOWN Banbridge, (Ireland), John P. Smyth, Esq., Jun., M.A., M.I.C.E.I., F.G.S.	200	July	29·674	0·929	86·0	39·0	47·0	68·5	50·0	18·5	58·0	50·1	·362	4·0	1·4	75	530	129·7	45·9	2·0	7	2	11	11	—	4·6	13	2·06
		Aug.	29·551	1·330	79·0	41·0	38·0	60·7	49·2	16·8	57·8	49·0	·348	3·9	1·4	72	528	123·3	45·3	2·2	8	4	10	9	—	4·5	14	2·87
		Sept.	29·422	0·927	66·0	34·0	32·0	59·4	46·7	12·7	52·7	47·0	·322	3·6	0·8	81	532	117·4	42·0	1·7	8	5	7	10	—	5·9	17	3·43

NOTE.—*The Barometer Reading*, Gloucester, 1st August, 9h. a.m., 29·944 in., has been altered to 29·944 in.
" " Helston, 7th " 9h. a.m., 29·250 in., " 30·250 in.
" " " 25th September, 9h. a.m., 29·020 in., " 30·020 in.
" " Chiswick, 28th " 3h. p.m., 29·374 in., " 29·374 in.

The Minimum Thermometer Reading, Gloucester, 25th August, 31°·0, has been altered to 41°·0.

Second Rain-gauges are placed—			July.		August.		September.		Total during the Quarter.	
At Beckenham,	at the height of 50 feet	*above the ground*, the amount collected was	0·18 inches.	-	2·22 inches.	-	2·34 inches.	-	4·74 inches.	
" Strathfield Turgiss,	" 38 feet	" "	0·79 "	-	2·12 "	-	2·95 "	-	5·86 "	
" Oxford,	" 22 feet	" "	0·86 "	-	2·62 "	-	5·47 "	-	8·95 "	
" Cardington,	" 36 feet	" "	1·00 "	-	1·70 "	-	4·50 "	-	7·20 "	
" Wisbech,	" 8 feet	" "	1·69 "	-	1·79 "	-	3·55 "	-	7·03 "	
" Nottingham,	" 39 feet	" "	0·87 "	-	1·46 "	-	3·40 "	-	5·73 "	
" Eccles (Manchester),	" 34 feet	" "	2·91 "	-	2·04 "	-	3·33 "	-	9·18 "	
" Milltown (Ireland),	" 40 feet	" "	— "	-	— "	-	3·17 "	-	— "	

NAMES OF STATIONS.	Mean Pressure of dry Air reduced to the level of the Sea.	Highest Reading of the Thermometer.	Lowest Reading of the Thermometer.	Range of Temperature in the Quarter.	Mean of all Highest.	Mean of all Lowest.	Mean Monthly Range of Temperature.	Mean Daily Range of Temperature.	Mean Temperature of the Air.	Mean Temperature of the Dew Point.	Mean Elastic Force of Vapour.	Mean Weight of Vapour in a cubic foot of Air.	Mean additional Weight required for saturation.	Mean degree of Humidity.	Mean Weight of a cubic foot of Air.	Mean Reading of Maximum in Rays of Sun.	Mean Reading of Minimum on Grass.	Wind. Mean Estimated Strength.	Wind. Relative Proportion of N.	Wind. Relative Proportion of E.	Wind. Relative Proportion of S.	Wind. Relative Proportion of W.	Mean Amount of Ozone.	Mean Amount of Cloud.	Rain. Number of Days on which it fell.	Rain. Mean Amount fell.
	in.	°	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°									
Guernsey	29·544	79·0	46·0	33·0	66·5	56·0	25·5	10·5	59·7	55·7	·444	4·9	0·8	87	530	—	—	1·4	7	5	9	10	3·7	4·1	40	7·
Helston	29·622	94·0	42·0	52·0	71·4	52·4	39·0	19·1	60·5	50·2	·366	4·1	1·8	69	532	103·6	49·3	2·0	7	5	9	10	5·1	4·9	40	9·
Truro	29·541	86·0	39·0	47·0	69·5	54·7	33·0	14·9	60·1	53·0	·402	4·5	1·3	78	532	—	—	2·5	7	6	6	11	—	5·8	49	10·
Plymouth	29·598	84·0	44·0	40·0	68·4	55·0	30·7	13·4	60·5	55·6	·444	5·0	1·0	84	532	—	52·9	1·7	8	7	4	12	—	5·9	41	10·
Ventnor	29·514	90·1	41·1	49·0	71·9	56·1	35·8	15·8	62·2	55·2	·437	4·8	1·4	78	530	—	—	—	—	—	—	—	7·7	—	36	9·
Osborne	29·481	93·9	42·0	51·9	73·3	53·9	41·9	19·4	62·2	57·4	·476	5·2	1·0	85	527	127·8	49·0	0·2	4	4	8	14	—	4·9	37	7·
Bournemouth	29·601	87·6	42·8	44·8	68·6	54·3	34·4	14·3	60·6	51·4	·379	4·2	1·7	72	531	—	—	—	7	4	5	15	—	2·6	38	8·
Brighton	29·534	84·5	45·1	39·4	68·7	54·8	30·8	13·9	60·6	53·1	·406	4·5	1·4	77	528	111·8	52·1	1·0	4	4	10	13	—	5·5	35	8·
Hastings	29·561	86·1	43·1	43·0	68·0	54·0	32·7	14·0	60·1	52·7	·400	4·4	1·4	77	530	—	50·4	1·7	6	4	7	13	—	5·1	40	7·
Salisbury	—	93·0	37·5	55·5	74·4	49·9	48·5	24·5	60·9	53·6	·415	4·6	1·3	77	—	120·1	47·0	1·6	7	2	3	18	—	5·5	34	7·
Barnstaple	29·521	94·0	47·5	46·5	70·9	57·7	36·8	13·2	62·8	54·7	·429	4·8	1·6	76	529	—	—	0·4	4	4	10	13	—	3·8	47	9·
Caterham	—	—	40·0	—	—	52·1	—	—	—	—	—	—	—	—	—	80·0	—	1·8	8	3	6	13	0·4	2·9	43	8·
Ramsgate	29·531	85·7	43·1	42·6	68·8	55·2	32·9	13·6	60·9	54·5	·428	4·8	1·2	80	530	113·4	50·2	1·8	7	6	10	8	—	5·4	42	5·
Strathfield Turgiss	29·554	94·5	38·2	56·3	72·1	52·5	45·0	19·6	61·1	53·1	·405	4·5	1·5	76	528	118·7	48·4	0·6	8	5	5	12	3·3	4·8	37	8·
East Tilbury	29·497	96·0	39·9	56·1	76·7	53·2	48·2	23·5	63·3	56·0	·450	4·7	1·4	77	528	109·7	49·0	0·3	4	5	9	12	—	5·6	36	3·
Marlborough Green	29·511	92·0	39·8	52·2	70·9	51·8	41·6	19·1	60·2	54·1	·420	4·7	1·2	81	523	118·9	47·9	0·2	7	4	6	14	—	5·3	43	11·
Beckenham	29·533	96·1	38·0	58·1	74·7	50·2	49·9	24·5	60·8	53·9	·418	4·7	1·3	79	528	—	—	—	5	6	7	12	—	—	41	5·
Blackheath	29·533	90·3	41·9	48·4	72·5	53·1	40·7	19·4	61·2	52·6	·396	4·4	1·6	74	528	111·1	50·5	1·2	6	5	9	11	—	5·1	42	5·
Streatley Vicarage	29·518	95·3	39·4	55·9	73·4	53·1	45·7	20·3	61·5	54·5	·426	4·8	1·3	78	528	—	—	1·6	9	4	6	12	—	4·7	44	11·
Chiswick	29·499	94·5	36·5	58·0	74·4	51·0	49·1	23·4	61·1	54·8	·433	4·8	1·2	80	531	131·3	46·7	0·8	4	5	7	14	—	6·6	33	5·
Camden Square	29·526	92·6	41·3	51·3	73·4	55·5	41·3	19·9	61·9	53·0	·408	4·5	1·6	74	526	120·8	49·9	—	10	1	6	13	—	5·3	41	5·
Oxford	29·515	90·3	41·3	49·0	70·9	52·8	39·8	18·0	61·5	52·7	·400	4·4	1·7	74	527	119·8	49·4	0·7	5	3	7	15	2·8	6·2	42	9·
Gloucester	29·540	96·0	40·5	55·5	74·8	51·6	47·5	23·2	61·2	55·3	·437	4·9	1·2	82	530	117·5	47·2	0·5	8	5	4	13	1·7	5·5	30	3·
Royston	29·573	94·8	39·6	55·2	73·4	50·2	45·5	23·2	60·4	51·8	·385	4·3	1·6	77	528	—	—	—	6	4	8	13	—	5·6	37	6·
Cardington	29·513	93·0	38·0	55·0	72·5	51·6	45·3	20·9	61·6	53·1	·404	4·5	1·6	75	529	107·0	45·6	1·4	6	4	6	14	—	5·4	41	8·
Cambridge	29·486	95·1	37·3	57·8	73·2	51·7	45·7	21·5	61·0	53·5	·412	4·6	1·4	77	530	136·8	46·9	1·5	6	4	9	12	—	5·3	47	6·
Semerleyton Rectory	—	87·0	40·6	46·4	70·0	51·3	38·0	18·7	59·3	53·7	·413	4·6	1·1	81	—	—	43·1	1·1	6	6	8	10	7·2	5·0	40	8·
Norwich	29·460	87·0	42·0	45·0	69·5	53·3	35·2	16·2	60·1	55·7	·446	5·0	0·9	86	531	—	—	—	5	7	8	11	—	—	41	8·
Leicester	29·548	91·9	38·0	53·9	69·2	52·2	42·3	17·0	60·0	50·3	·365	4·1	1·7	71	528	120·3	—	0·9	5	5	8	13	—	6·1	42	7·
Wisbech	29·489	92·0	41·3	50·7	71·6	52·2	40·7	19·4	61·1	53·6	·412	4·6	1·5	77	531	113·9	48·3	0·6	6	3	9	13	3·4	5·3	43	7·
Nottingham	29·504	93·6	36·0	57·6	71·7	50·4	48·5	21·3	59·6	51·6	·384	4·3	1·5	75	529	117·0	47·0	0·4	7	5	6	12	1·7	5·8	51	6·
Llandudno	29·506	86·6	41·5	45·1	67·8	53·7	36·0	14·1	59·3	52·1	·390	4·4	1·3	78	531	—	—	0·7	5	3	5	18	—	6·1	45	9·
Caleethorpe	29·523	83·2	41·9	41·3	65·9	50·3	35·1	15·6	56·9	51·6	·383	4·3	0·9	82	528	119·9	46·7	0·9	5	5	7	13	7·4	6·9	51	8·
Liverpool	29·538	84·8	42·0	42·8	65·3	53·6	34·0	11·7	58·2	50·0	·361	4·0	1·4	74	530	—	—	1·2	4	5	6	15	—	5·3	44	8·
Eccles	29·527	93·0	36·0	57·0	68·4	49·7	47·6	18·7	58·0	50·7	·371	4·2	1·2	77	531	83·1	42·9	0·3	8	3	6	13	1·3	6·5	56	10·
Bermerside, Halifax	29·532	90·3	37·4	52·9	67·0	48·3	—	18·7	56·6	49·6	·357	4·0	1·2	78	525	108·8	—	0·5	4	6	9	12	—	5·6	41	10·
Hull	29·486	87·0	42·0	45·0	68·2	51·6	35·7	16·5	58·9	52·4	·395	4·4	1·2	77	533	94·7	47·8	—	—	—	—	—	1·5	—	39	7·
Stonyhurst	29·505	87·2	38·1	49·1	67·6	51·0	41·3	16·6	58·3	51·1	·379	4·2	1·2	78	526	120·9	48·4	—	6	4	6	15	—	6·7	55	15·
Leeds	29·459	94·0	43·0	51·0	70·8	52·5	42·0	18·3	60·6	54·1	·421	4·7	1·3	79	528	96·6	—	1·4	5	7	6	13	—	4·3	40	6·
Bradford	29·558	87·6	44·0	43·6	66·4	52·9	33·8	13·5	58·3	48·0	·339	3·8	1·7	79	527	91·3	—	0·8	5	6	3	16	—	5·9	47	7·
Cockermouth	29·510	88·3	37·8	50·5	66·1	50·7	40·7	15·3	57·3	49·2	·350	3·9	1·3	75	532	104·7	43·0	0·3	5	4	8	13	1·6	4·9	47	10·
Allenheads	—	—	33·0	—	—	46·9	—	—	—	—	—	—	—	—	—	111·6	43·1	1·1	5	5	8	12	—	5·9	55	10·
Silloth	29·488	88·5	37·4	51·1	70·9	49·7	44·0	21·2	58·5	51·8	·386	4·4	1·2	79	533	105·5	46·3	1·3	4	5	10	12	6·9	4·6	43	9·
Carlisle	29·501	91·2	35·9	55·3	67·4	48·0	46·6	19·4	57·7	49·7	·357	4·0	1·3	75	532	102·4	43·0	1·7	5	5	6	15	5·1	5·1	51	8·
Bywell	29·449	87·0	37·0	50·0	68·6	53·1	37·0	15·5	58·4	51·0	·375	4·2	1·3	77	531	93·8	47·5	1·2	8	5	3	15	—	4·2	44	7·
North Shields	—	82·5	39·6	42·9	62·0	51·1	30·1	10·9	55·7	48·7	·345	3·9	1·1	77	535	—	50·0	1·5	8	5	5	12	—	6·1	48	6·
Milltown (Ireland)	—	86·0	34·0	52·0	64·9	48·9	39·0	16·0	56·2	48·7	·344	3·8	1·2	76	530	123·5	44·4	2·0	8	4	9	10	—	4·7	44	8·

The highest temperatures of the air were at Beckenham, 96°·1; and at Gloucester, 96°·0.
The lowest temperatures of the air were at Allenheads, 33°·0; and at Milltown (Ireland), 34°·0.
The greatest daily ranges of the temperatures of the air were at Salisbury and Beckenham, both 24°·5.
The least daily ranges of the temperatures of the air were at Guernsey, 10°·5; and at North Shields, 10°·9.
The greatest numbers of rainy days were at Eccles, 56; and at Stonyhurst and Allenheads, both 55.
The least numbers of rainy days were at Gloucester, 30; and at Chiswick, 33.
The heaviest falls of rain were at Stonyhurst, 15·01 inches; and at Marlborough, 11·62 inches.
The least falls of rain were at East Tilbury, 3·82 inches; and at Ramsgate, 5·01 inches.

Quarterly Meteorological Table for different Parallels of Latitude.

PARALLELS OF LATITUDE, &c.	Mean Pressure of dry Air reduced to the level of the Sea.	Mean of all Highest Readings of the Thermometer.	Mean of all Lowest Readings of the Thermometer.	Mean Range of Temperature in the Quarter.	Mean of all Highest.	Mean of all Lowest.	Mean Monthly Range of Temperature.	Mean Daily Range of Temperature.	Mean Temperature of the Air.	Mean Temperature of the Dew Point.	Mean Elastic Force of Vapour.	Mean Weight of Vapour in a cubic foot of Air.	Mean additional Weight required for saturation	Mean degree of Humidity.	Mean Weight of a cubic foot of Air.	Mean Reading of Maximum in Rays of Sun.	Mean Reading of Minimum on Grass.	Wind. Mean Estimated Strength.	Wind. Relative Proportion of N.	Wind. Relative Proportion of E.	Wind. Relative Proportion of S.	Wind. Relative Proportion of W.	Mean Amount of Ozone.	Mean Amount of Cloud.	Rain. Mean Number of Days it fell.	Rain. Mean Amount fell.
	in.	°	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°									
Guernsey	29·544	79·0	46·0	33·0	66·5	56·0	25·5	10·5	59·7	55·7	·444	4·9	0·8	87	530	—	—	1·4	7	5	9	10	3·7	4·1	40	7·
Between the latitudes 50° and 51°	29·556	88·3	42·4	45·9	70·0	54·4	35·0	15·6	60·9	53·6	·414	4·6	1·4	78	530	114·4	50·7	1·5	6	5	7	13	6·4	5·0	40	9·
Between the latitudes 51° and 52°	29·523	90·1	40·3	52·8	72·9	52·7	43·6	20·2	61·4	54·1	·421	4·7	1·4	77	528	114·8	48·6	1·0	6	4	7	13	2·1	5·1	39	7·
Between the latitudes 52° and 53°	29·510	91·8	39·1	52·7	71·4	51·6	42·6	19·8	60·4	52·9	·403	4·5	1·4	77	530	119·4	46·2	1·0	6	5	8	12	4·1	5·5	43	7·
Between the latitudes 53° and 54°	29·509	88·3	40·2	48·1	67·6	51·3	38·8	16·3	58·4	51·4	·382	4·3	1·2	78	530	104·0	46·5	0·8	5	5	7	14	3·4	5·8	46	9·
Between the latitudes 54° and 55°	29·501	88·5	38·4	50·1	67·9	50·9	40·4	17·0	58·0	49·9	·361	4·1	1·4	75	531	101·6	44·8	1·1	5	5	6	14	4·4	5·1	48	8·
Mean for the Quarter, 50° to 55°, Year 1873	29·536	87·5	36·6	50·9	67·9	51·3	37·5	16·6	58·4	51·9	·389	4·3	1·2	79	529	103·2	45·5	1·0	4	3	9	15	4·2	5·6	49	8·
Mean for the Quarter, 50° to 55°, " 1874	29·527	85·3	40·2	45·1	69·3	51·6	36·7	17·7	59·2	52·0	·389	4·4	1·3	78	529	108·8	46·2	1·2	4	4	9	14	3·6	5·6	47	8·
Mean for the Quarter, 50° to 55°, " 1875	29·593	81·5	41·6	39·9	68·9	52·3	35·9	16·6	59·3	53·1	·405	4·5	1·2	80	531	101·8	48·1	1·2	6	8	7	10	3·5	5·9	45	10·
Mean for the Quarter, 50° to 55°, " 1876	29·520	90·0	40·1	49·9	70·0	52·2	40·1	17·8	59·8	52·4	·396	4·4	1·4	77	530	110·8	47·4	1·1	6	5	7	13	4·1	5·3	43	8·

METEOROLOGY OF ENGLAND,

DURING THE QUARTER ENDING DECEMBER 31, 1876.

REMARKS ON THE WEATHER DURING THE QUARTER ENDING DECEMBER 31ST, 1876.

By JAMES GLAISHER, ESQ., F.R.S., *&c.*

Till the 20th of October the weather was warm with frequent rain, the average excess of mean temperature was 5¼° daily: from October 21st to November 12th, it was mostly cold, with but little rain, the average deficiency of temperature was 3¼° daily, and from November 13th to the end of the year, with the exception of the six days December 21st to December 26th, the weather was warm, and at times very warm, with very frequent rain; the average daily excess of temperature for the 38 days ending December 20th was 4¼°; the average deficiency for the six days ending December 26th was 3¼° daily, and the average excess for the last five days of the year was 12¼°.

The most remarkable phenomena in this quarter were, the very small atmospheric pressure, the high temperature, and the extraordinary falls of rain in the month of December.

At the height of 160 feet above the level of the sea, the mean reading of the barometer in December was 29·311 in., and back to 1841 there is no instance in any month of so low a reading, the least mean monthly atmospheric pressures previously experienced were 29·379 in. and 29·413 in. both in December, in the years 1868 and 1872 respectively.

The mean temperature of the air in December was 44°1, and back to 1771 there have only been nine Decembers in which the temperature has been so high.

The fall of rain in December was exceedingly anomalous, at about London and its neighbourhood it amounted to nearly 6 in., and back to 1815 there has been no instance of so great a fall in December; the previous instances of monthly falls equalling this amount nearly, were 7·0 in. in July 1828; 6·0 in. in October 1841; 6·0 in. in November 1852: 5·8 in. in June 1860; and 5·8 in July 1867.

The fall of rain was large everywhere, rain fell on every day in December, but on the 10th to only a small amount and at a few places, on the 8th, 9th, 11th, 12th, 13th, 14th, 15th, and 22nd it fell to the amount of 0·2 in. or 0·3 in., but was not quite general; on every other day rain was general, and exceeded half an inch in amount at one or more places, and on 12 days the amount was one inch or more at at least one station. The following Table shows the fall of rain on those 12 days at the several stations:—

FALL OF RAIN at the different STATIONS on Twelve selected days.

Names of Stations.	DECEMBER.											
	2nd.	3rd.	4th.	5th.	6th.	17th.	21st.	22nd.	24th.	26th.	27th.	31st.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
Guernsey	0·82	0·20	0·61	0·35	1·20	0·14	1·48	0·13	0·30	0·03	0·55	0·08
Helston	0·15	1·00	1·21	0·13	0·08	0·07	0·06	0·00	0·12	0·08	0·95	0·10
Truro	0·35	1·10	1·03	0·19	0·20	0·22	0·15	0·13	0·24	1·69	0·55	0·55
Plymouth	0·59	0·34	0·54	0·25	0·30	0·79	0·14	0·00	0·11	0·00	0·22	0·42
Ventnor	0·48	0·56	0·29	0·31	0·48	0·48	0·30	0·69	0·02	0·48	0·43	0·02
Osborne	0·42	0·88	0·29	0·75	0·41	0·29	0·01	0·33	0·03	0·67	0·62	0·12
Bournemouth	0·40	0·38	0·00	0·15	0·33	0·27	0·30	0·01	0·43	0·00	0·61	0·29
Portsmouth	0·59	0·43	0·50	0·17	0·28	0·00	0·00	0·13	0·39	0·00	0·29	0·00
Hastings	0·35	0·44	0·49	0·08	0·43	0·14	0·76	0·88	0·00	0·37	0·25	0·05
Brighton	0·42	0·42	0·16	0·52	0·20	0·30	0·00	0·94	0·00	0·43	0·25	0·03
Taunton	0·28	0·96	0·25	0·35	0·00	0·69	0·00	0·00	0·00	0·70	0·36	0·00
Salisbury	0·35	0·83	0·31	0·67	0·26	0·20	0·00	0·49	0·00	0·94	0·63	0·35
Barnstaple	0·45	0·33	0·62	0·56	0·17	0·77	0·10	0·12	0·00	0·25	0·29	0·30
Caterham		2·12			0·00	0·40	0·83	0·00	—	0·00	1·75	0·07
Ramsgate	0·17	0·00	0·71	0·44	0·29	0·00	1·00	0·27	0·00	0·08	0·06	0·00
Strathfield Turgiss	0·23	0·44	0·07	0·45	0·27	0·22	0·00	0·32	0·00	0·33	0·19	0·19
Weybridge Heath	0·26	0·48	0·15	0·36	0·03	0·33	0·00	1·00	0·15	0·22	0·16	0·16
East Tilbury	0·50	0·38	0·10	0·33	0·16	0·17	0·05	1·43	0·09	0·22	0·01	0·13
Marlborough	0·38	0·42	0·66	0·13	0·43	0·07	0·18	0·27	0·00	0·00	0·48	0·31
Bristol	0·39	0·54	0·14	0·50	0·33	0·43	0·01	0·03	0·03	0·47	0·39	0·49
Blackheath	0·50	0·02	0·61	0·39	0·02	0·00	0·01	0·42	1·09	0·07	0·18	0·07
Royal Observatory	0·36	0·05	0·46	0·39	0·00	0·01	0·00	0·95	0·54	0·09	0·16	0·06
Streatley	0·35	0·38	0·54	0·04	0·54	0·21	0·27	—	—	—	0·31	0·24
Chiswick	0·32	0·30	0·43	0·10	0·25	0·09	0·61	0·00	1·49	0·28	0·08	0·20
Camden Square	0·34	0·37	0·13	0·27	0·06	0·31	0·00	1·61	0·14	0·32	0·09	0·11
Oxford	0·57	0·42	0·13	0·24	0·02	0·30	0·00	0·00	0·43	0·27	0·09	0·13
Gloucester	0·25	0·00	0·21	0·17	0·38	0·02	0·42	0·03	0·00	0·00	0·30	0·30
Royston	0·40	0·39	0·14	0·34	0·03	0·27	0·00	0·74	0·39	0·29	0·03	0·24
Cardington	0·39	0·16	0·12	0·24	0·00	0·30	0·00	0·65	0·51	0·25	0·01	0·10
Lampeter	0·21	0·75	0·43	0·14	0·33	1·09	0·00	—	0·00	0·00	0·97	1·42
Cambridge	0·04	0·35	0·21	0·16	0·21	0·00	0·18	0·02	0·23	0·00	0·21	0·09
Norwich	0·24	0·18	0·19	0·26	0·36	0·00	0·22	0·00	0·03	0·00	0·17	0·19
Leicester	0·07	0·49	0·39	0·16	0·24	0·35	0·19	0·00	0·64	0·01	0·22	0·35
Birmingham	—	0·62	0·44	0·19	0·47	—	—	—	—	—	—	0·61
Wolverhampton	0·57	0·46	0·12	0·26	0·02	0·01	0·00	0·00	0·01	0·24	0·16	—
Wisbech	0·47	0·23	0·03	0·10	0·00	0·20	0·00	0·09	0·08	0·31	0·02	0·06
Nottingham	0·10	0·60	0·20	0·10	0·39	0·43	0·13	0·01	0·35	0·01	0·20	0·33
Holkham	0·25	0·20	0·10	0·06	0·28	0·00	0·11	0·05	0·00	0·00	0·21	0·22
Llandudno	0·56	0·36	0·37	0·08	0·02	0·29	0·09	0·00	0·00	0·00	0·00	0·24
Sheffield	0·88	0·38	0·21	1·14	0·02	0·13	0·11	0·00	Snow.	Snow.	0·80	0·38
Calecthorpe	0·40	0·27	0·03	0·43	0·00	0·08	0·05	0·23	0·18	0·57	0·04	0·28
Liverpool	0·28	0·57	0·27	0·31	0·11	0·16	0·24	0·04	0·00	0·00	0·32	0·41
Manchester	0·32	0·09	0·26	0·74	0·04	0·01	0·25	0·00	—	—	—	0·22
Eccles	0·41	0·15	0·24	0·71	0·04	0·10	0·02	0·00	0·00	0·49	0·33	0·26
Bermerside	0·44	1·50	0·34	0·35	0·74	0·28	0·55	0·03	0·00	0·00	0·90	0·80
Hull	0·47	0·18	0·15	1·07	0·03	0·17	0·04	0·25	0·04	0·42	0·04	0·40
Stonyhurst	0·26	0·43	0·08	0·41	0·66	0·09	0·46	0·04	0·00	0·00	0·46	0·66
Bradford	0·21	0·90	0·48	0·22	0·53	0·49	0·48	0·00	0·06	0·01	0·53	0·77
Leeds	0·73	0·38	0·13	0·22	0·01	0·17	0·08	0·06	0·24	0·54	0·10	0·28
Cockermouth	0·33	0·66	0·15	0·36	0·31	0·03	0·10	0·06	0·00	0·00	0·34	1·05
Allenheads	1·00	0·68	0·29	0·50	0·14	0·29	1·10	0·12	0·18	0·00	0·13	0·89
Silloth	0·43	0·11	0·25	0·27	0·08	0·20	0·11	0·00	0·00	0·71	0·50	0·35
Sunderland	0·32	0·82	0·14	0·08	0·35	0·10	0·68	0·00	0·47	0·02	0·34	0·33
Carlisle	0·25	0·11	0·29	0·44	0·10	0·04	0·09	0·00	0·00	Snow.	0·60	0·90
Bywell	1·25	0·34	0·20	0·32	0·05	0·18	1·28	0·26	0·24	0·25	0·26	0·25
North Shields	0·82	0·09	0·05	0·35	0·00	0·10	0·74	0·39	0·11	0·33	0·45	0·05
Milltown (Ireland)	1·45	0·50	0·02	0·84	0·00	0·17	0·09	0·00	0·30	0·23	0·35	0·34

MONTHLY METEOROLOGICAL TABLE FOR THE QUARTER ENDING DECEMBER 31st, 1876.

The Observations have been reduced to Mean values by Glaisher's Barometrical and Diurnal Range Tables, and the Hygrometrical results have been deduced from the fifth edition of his Hygrometrical Tables.

Names of Stations and Observers.	Height of Station above Sea Level.	Year 1876.	Pressure of Atmosphere in Month.		Temperature of Air in Month.						Mean Temperature.		Vapour.			Mean Degree of Humidity. Sat^{n}. = 100.	Mean Weight of a cubic foot of Air.	Mean Reading of Thermometer.		Wind.					Mean Amount of Ozone.	Mean Amount of Cloud.	Rain.	
								Mean						In a cubic foot of Air.						Estimated Strength.	Relative Proportion of						
		Months.	Mean.	Range.	Highest.	Lowest.	Range.	Of all Highest.	Of all Lowest.	Daily Range.	Air.	Dew Point.	Elastic Force.	Mean.	Short of Saturation.			Maximum in Rays of Sun.	Minimum on Grass.		N.	E.	S.	W.			Number of Days it fell.	Amount collected.
	feet.		in.	in.	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°								in.
GUERNSEY, Samuel Elliott Hoskins, Esq., M.D., F.R.S., F.M.S.	204	Oct.	29·678	0·944	68·5	45·0	23·5	59·4	52·6	6·8	55·2	50·1	·363	4·1	0·8	84	533	—	—	1·2	4	11	12	4	2·9	6·6	19	3·23
		Nov.	29·647	1·316	60·0	32·0	28·0	53·5	44·7	8·8	48·8	44·1	·290	3·2	0·6	84	540	—	—	1·4	6	7	9	8	5·6	6·1	17	5·48
		Dec.	29·262	1·622	60·0	36·5	23·5	52·0	45·0	7·0	48·6	45·1	·301	3·4	0·5	88	533	—	—	2·1	3	5	13	10	4·6	7·2	27	11·47
HELSTON (Cornwall), Matthew P. Moyle, Esq., M.R.C.S.	106	Oct.	29·750	1·208	68·0	30·0	38·0	60·4	50·3	10·1	51·7	49·8	·357	4·0	0·8	83	535	70·0	45·8	1·7	5	12	11	3	6·2	6·1	18	4·21
		Nov.	29·695	1·288	66·0	28·0	38·0	56·2	42·6	13·6	49·2	42·6	·274	3·1	0·9	78	540	63·4	38·8	2·0	4	8	10	8	5·2	6·1	15	4·44
		Dec.	29·284	1·776	57·0	30·0	27·0	53·9	40·7	13·2	47·8	42·5	·272	3·1	0·7	83	534	58·4	37·3	2·5	6	5	11	9	7·0	7·3	25	8·31
TRURO (Cornwall), C. Barham, Esq., M.D., F.M.S.	43	Oct.	29·805	1·080	68·0	35·0	33·0	59·5	49·6	9·9	53·6	49·5	·354	4·0	0·6	86	537	—	—	2·3	6	11	9	5	—	7·3	18	4·60
		Nov.	29·790	1·314	59·6	21·0	38·6	51·3	46·1	5·2	48·1	42·9	·275	3·2	0·7	82	544	—	—	2·0	5	10	7	8	—	6·4	18	5·47
		Dec.	29·378	1·660	57·0	30·0	27·0	52·9	41·8	11·1	47·6	44·2	·290	3·3	0·5	89	536	—	—	2·6	5	3	12	11	—	7·5	27	10·39
PLYMOUTH (Devon), John Merrifield, Esq., F.R.A.S., F.M.S., LL.D.	69	Oct.	29·885	1·012	67·0	39·0	28·0	59·1	50·6	8·5	54·0	51·2	·377	4·3	0·4	90	538	—	49·7	1·4	6	12	8	5	—	8·0	18	4·05
		Nov.	29·859	1·404	58·5	27·0	31·5	53·1	40·6	12·5	46·7	43·8	·286	3·2	0·4	91	546	—	40·7	1·2	6	9	7	8	—	6·2	15	4·54
		Dec.	29·421	1·819	58·5	30·0	28·5	51·6	42·4	9·2	47·1	44·8	·297	3·4	0·3	92	537	—	41·4	1·5	4	5	13	9	—	8·1	26	8·85
VENTNOR (Royal National Hospital), Isle of Wight, Hartley Nagar, Esq.	100	Oct.	29·939	0·918	71·0	36·7	34·3	62·4	51·8	10·6	55·7	51·5	·381	4·3	0·7	86	537	—	—	—	—	—	—	—	6·3	—	12	1·51
		Nov.	29·892	0·950	65·1	29·1	36·0	56·7	43·7	13·0	48·8	44·5	·295	3·3	0·6	85	544	—	—	—	6	5	8	11	7·3	6·2	17	4·06
		Dec.	29·520	1·516	59·8	31·2	28·6	52·0	43·6	8·4	47·3	44·4	·292	3·3	0·4	91	539	—	—	—	6	3	10	12	7·8	8·5	25	7·48
OSBORNE (Isle of Wight), J. R. Mann, Esq.	172	Oct.	29·728	1·064	69·2	32·4	36·8	59·2	48·1	11·1	53·3	50·7	·370	4·2	0·4	91	536	89·1	42·7	0·1	7	9	10	5	—	7·1	14	1·86
		Nov.	29·688	1·102	60·7	27·1	33·6	52·0	39·6	12·4	45·8	42·6	·273	3·2	0·4	89	544	78·8	31·6	0·1	5	6	8	8	—	5·8	18	3·63
		Dec.	29·297	1·808	55·2	27·5	27·7	49·1	40·1	9·0	45·2	43·0	·277	3·1	0·3	92	537	59·5	32·9	0·3	3	5	15	8	—	8·0	26	7·28
SOUTH BOURNE, (near) Bournemouth (Hants), T. A. Compton, Esq., M.D., B.A., F.M.S.	128	Oct.	29·781	0·980	65·3	32·0	33·3	58·3	50·1	8·2	53·6	49·4	·355	4·0	0·6	86	537	—	—	—	8	9	9	5	—	5·6	16	2·62
		Nov.	29·743	1·210	58·4	24·1	34·3	51·7	38·7	13·0	45·3	41·2	·258	3·0	0·5	86	546	—	—	—	8	6	6	10	—	3·2	14	3·85
		Dec.	29·329	1·920	57·3	27·7	29·6	49·5	42·4	7·1	46·3	43·5	·272	3·1	0·5	87	537	—	—	—	8	4	11	8	—	8·1	24	7·98
BRIGHTON (Sussex), F. E. Sawyer, Esq., F.M.S.	203	Oct.	29·710	1·060	69·0	35·6	33·4	59·1	50·6	8·5	54·1	49·3	·353	4·0	0·7	84	536	—	46·6	1·0	8	12	7	4	—	7·2	8	0·66
		Nov.	29·670	1·437	60·4	29·0	31·4	50·0	40·8	9·2	45·2	41·5	·262	3·0	0·4	87	544	—	37·6	1·1	9	5	8	8	—	6·3	15	3·10
		Dec.	29·284	1·709	56·4	30·0	26·4	49·0	43·2	5·8	46·0	40·2	·250	3·2	0·7	81	536	—	39·5	1·5	4	6	15	6	—	9·0	22	6·93
HASTINGS (Sussex), Alex. E. Murray, Esq., F.M.S.	167	Oct.	29·761	1·021	68·3	33·7	34·6	58·9	50·2	8·7	53·9	49·4	·351	4·0	0·7	85	536	—	46·3	1·5	10	6	11	4	—	7·1	11	1·77
		Nov.	29·701	1·293	60·2	28·5	31·7	49·9	40·6	9·3	45·1	41·6	·263	3·0	0·4	87	545	—	38·1	1·4	8	4	10	8	—	6·0	19	3·79
		Dec.	29·329	1·685	55·3	31·4	23·9	49·3	42·4	6·9	46·1	42·7	·275	3·2	0·4	88	537	—	40·4	1·8	6	5	14	6	—	8·4	24	7·19
TAUNTON (Somerset), W. Tuckwell, Esq.	80	Oct.	29·807	1·168	74·0	35·0	39·0	59·8	48·5	11·3	53·7	50·5	·367	4·1	0·5	89	537	67·9	44·9	0·2	5	8	14	4	1·8	6·9	15	2·45
		Nov.	29·758	1·243	62·8	22·0	40·8	51·8	37·8	14·0	44·7	41·2	·279	3·2	0·1	94	546	58·7	34·1	0·2	7	8	6	9	1·8	7·0	17	4·37
		Dec.	29·370	1·988	57·0	25·0	32·0	49·8	39·1	10·7	45·0	43·7	·285	3·0	0·4	95	539	53·7	37·1	0·2	4	7	14	6	5·6	7·9	22	7·70
SALISBURY (Wilton House), T. Challis, Esq.	186	Oct.	29·707	1·096	75·0	31·0	44·0	60·5	44·9	15·6	51·9	48·9	·347	3·9	0·5	89	537	84·2	42·3	1·4	7	9	8	7	—	7·2	16	2·34
		Nov.	29·644	1·248	61·0	21·0	40·0	51·6	34·3	17·3	41·1	40·7	·254	2·9	0·3	91	546	72·9	32·2	1·3	11	5	7	7	—	6·2	19	3·00
		Dec.	29·234	1·906	57·5	23·0	34·5	48·2	37·5	10·7	43·6	41·0	·257	2·8	0·3	90	538	59·1	36·7	1·6	4	7	9	11	—	8·2	25	9·04
BARNSTAPLE (Devon), T. Mackrell, Esq.	43	Oct.	29·835	1·170	73·0	46·0	27·0	61·1	51·8	9·3	55·3	49·8	·359	4·1	0·9	83	536	—	—	1·4	4	11	14	2	—	5·1	15	3·58
		Nov.	29·794	1·280	61·0	23·5	37·5	53·2	40·9	12·3	46·9	42·3	·279	3·1	0·6	85	545	—	—	1·2	4	7	10	9	—	5·5	19	3·53
		Dec.	29·355	1·650	59·5	32·0	27·5	51·1	42·0	9·1	46·8	40·2	·251	2·9	0·7	82	538	—	—	1·8	2	8	16	5	—	5·8	25	6·91

Names of Stations and Observers.	Height of Station above Sea Level.	Year 1876.	Pressure of Atmosphere in Month.		Temperature of Air in Month.						Mean Temperature.		Vapour.			Mean Degree of Humidity. Sat^{n}. = 100.	Mean Weight of a cubic foot of Air.	Mean Reading of Thermometer.		Wind.					Mean Amount of Ozone.	Mean Amount of Cloud.	Rain.	
								Mean						In a Cubic foot of Air.						Estimated Strength.	Relative Proportion of						Number of Days it fell.	Amount collected.
		Months.	Mean.	Range.	Highest.	Lowest.	Range.	Of all Highest.	Of all Lowest.	Daily Range.	Air.	Dew Point.	Elastic Force.	Mean.	Short of Saturation.			Maximum in Rays of Sun.	Minimum on Grass.		N.	E.	S.	W.				
	feet.		in.	in.	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°									in.
CATERHAM (Surrey), James Adam, Esq., M.D.	660	Oct.	29·200	0·950	80·0	29·0	51·0	60·0	45·9	14·1	52·6	48·2	·359	3·8	0·7	85	529	—	—	1·7	5	7	11	8	1·3	4·1	14	2·25
		Nov.	29·198	1·230	58·0	20·0	38·0	46·8	26·8	10·0	42·9	39·4	·242	2·8	0·4	87	538	—	—	1·8	2	6	8	7	0·1	3·4	17	3·15
		Dec.	28·826	1·520	52·0	26·0	26·0	44·3	36·7	7·6	41·8	40·0	·247	2·9	0·2	94	533	—	—	2·0	4	5	13	9	0·2	4·3	21	8·22
RAMSGATE (St. Augustine's Monastery), Rev. T. Hugh Quelch, O.S.B.	108	Oct.	29·825	0·881	69·6	38·9	30·7	59·5	51·0	8·5	55·0	49·5	·354	4·0	0·9	82	536	91·1	37·3	1·6	9	8	8	6	—	6·8	6	1·03
		Nov.	29·777	1·137	59·5	29·2	30·3	49·5	40·3	9·2	44·9	41·9	·266	3·0	0·4	90	547	80·7	32·0	1·9	9	3	9	9	—	6·6	18	4·06
		Dec.	29·408	1·590	60·5	29·0	31·5	49·4	41·7	7·7	46·0	42·4	·271	3·2	0·4	88	539	62·7	30·0	2·1	3	6	14	8	—	8·3	18	4·99
STRATHFIELD TURGISS (Hants), Rev. C. H. Griffith, M.A., F.M.S.	197	Oct.	29·722	1·093	69·7	33·0	36·7	59·0	46·5	12·5	52·3	48·7	·344	3·9	0·5	88	537	91·4	41·5	0·5	7	8	9	7	2·0	7·0	13	1·83
		Nov.	29·674	1·117	62·6	25·2	37·4	50·0	37·3	12·7	43·4	39·9	·246	2·8	0·4	88	546	74·4	32·1	0·5	10	6	7	7	2·0	6·2	17	4·23
		Dec.	29·274	1·881	57·4	27·0	30·4	47·8	40·0	7·8	44·2	41·6	·263	3·0	0·3	91	538	59·8	35·8	0·7	5	5	15	6	2·5	9·0	24	5·29
WEYBRIDGE HEATH (Surrey), William F. Harrison, Esq., F.M.S.	150	Oct.	29·793	0·591	72·0	30·3	41·7	59·8	46·1	13·7	52·0	49·0	·348	4·0	0·4	89	539	81·3	45·0	0·5	6	8	14	3	0·5	7·0	15	1·69
		Nov.	29·727	1·151	65·5	24·0	42·5	49·1	37·1	12·0	43·0	39·7	·244	2·8	0·4	88	548	64·2	33·7	0·6	8	5	10	7	0·7	7·0	18	2·89
		Dec.	29·352	1·822	55·8	26·0	29·8	46·8	39·5	7·3	43·6	40·9	·256	3·0	0·3	90	540	51·3	37·1	1·0	4	7	14	6	1·3	7·5	24	5·79
EAST TILBURY Vicarage (Essex), Rev. R. Tyas, M.A., LL.D.	29	Oct.	29·908	0·962	77·0	31·8	45·2	62·1	47·4	14·7	54·2	49·2	·350	3·3	0·8	83	539	72·6	43·7	0·1	7	8	9	7	—	7·0	8	0·68
		Nov.	29·890	1·058	62·4	30·6	31·8	52·1	36·2	15·9	44·3	42·1	·268	3·1	0·3	92	549	53·7	33·0	0·1	9	2	10	9	—	6·0	17	3·17
		Dec.	29·484	1·710	61·6	25·0	36·6	50·0	38·2	11·8	44·1	40·6	·253	2·9	0·4	87	542	49·5	35·5	0·1	3	7	15	6	—	8·5	25	5·06
MARLBOROUGH, The Green (Wilts), Rev. Thomas A. Preston, M.A., F.M.S.	474	Oct.	29·412	1·011	70·3	32·0	38·3	58·9	46·7	12·2	51·6	48·4	·340	3·8	0·5	89	532	68·9	41·7	0·2	9	9	7	6	—	7·8	15	2·57
		Nov.	29·347	1·240	60·8	25·9	34·9	49·1	37·0	12·1	42·7	40·0	·248	2·9	0·3	90	541	76·1	31·3	0·2	2	4	8	2	—	7·1	16	4·04
		Dec.	28·915	1·929	55·5	28·6	26·9	47·0	39·4	7·6	43·3	40·9	·256	2·9	0·3	91	533	58·6	36·1	0·3	2	9	11	2	—	8·3	22	7·29
BECKENHAM (Kent), C. O. F. Cator, Esq., M.A., F.M.S.	170	Oct.	29·731	1·086	75·8	33·0	42·8	61·0	44·3	16·7	51·8	48·6	·343	3·9	0·5	89	538	—	—	—	6	10	11	4	—	6·7	14	1·32
		Nov.	29·698	1·031	64·4	21·0	43·4	50·4	36·1	14·3	43·0	40·1	·249	2·8	0·4	90	547	—	—	—	5	7	10	8	—	6·1	17	2·88
BLACKHEATH (London), James Glaisher, Esq., F.R.S.	160	Oct.	29·756	1·098	73·6	34·2	39·4	60·2	46·9	13·3	52·7	47·3	·327	3·7	0·8	82	537	91·8	44·3	0·2	5	9	11	6	—	7·2	12	1·72
		Nov.	29·698	1·254	63·8	27·2	36·6	49·9	38·3	11·6	44·6	39·0	·228	2·7	0·6	82	546	75·4	36·2	0·8	6	7	9	8	—	6·9	15	3·13
		Dec.	29·389	1·821	58·1	27·9	30·2	48·6	39·5	9·1	44·3	40·2	·249	2·9	0·5	86	539	58·5	37·6	1·1	3	6	16	6	—	8·1	25	5·92
STREATLEY VICARAGE (Berks), Rev. J. Slatter, M.A., F.R.A.S., F.M.S.	150	Oct.	29·762	0·941	70·0	34·2	35·8	60·8	48·2	12·6	53·6	49·3	·350	4·0	0·6	85	536	—	—	1·6	5	8	10	8	—	7·7	14	1·36
		Nov.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	10	2·97
		Dec.	29·305	1·891	56·2	28·2	28·0	47·9	40·3	7·6	44·7	41·7	·263	3·0	0·4	89	538	—	—	1·8	3	7	12	9	—	8·5	23	5·62
CHISWICK (Middlesex).		Oct.	29·872	1·086	72·5	31·0	41·5	61·6	46·6	15·1	53·4	48·6	·342	3·9	0·7	84	539	90·1	42·4	0·7	2	10	8	10	—	7·5	11	1·68

Meteorological Tables, Quarter ending December 31st, 1876.

MONTHLY METEOROLOGICAL TABLE FOR THE QUARTER ENDING DECEMBER 31st, 1876.

The Observations have been reduced to Mean values by Glaisher's Barometrical and Diurnal Range Tables, and the Hygrometrical results have been deduced from the fifth edition of his Hygrometrical Tables.

Districts.	Height above Sea-level.	Mean Reading of Barometer at 32°.	Mean Temperature of Air.	Highest Temperature in the Quarter.	Lowest Temperature in the Quarter.	Range of Temperature in the Quarter.	Mean of all Highest.	Mean of all Lowest.	Mean Monthly Range of Temperature.	Mean Daily Range of Temperature.	Mean Temperature of the Air.	Mean Temperature of the Dew Point.	Mean Elastic Force of Vapour.	Mean Weight of Vapour in a cubic foot of Air.	Mean additional Weight required for saturation.	Mean degree of Humidity.	Mean Weight of a cubic foot of Air.	Mean Reading of Maximum in Rays of Sun.	Mean Reading of Minimum on Grass.	Wind. Mean Estimated Strength.	Wind. Relative Proportion of N.	Wind. Relative Proportion of E.	Wind. Relative Proportion of S.	Wind. Relative Proportion of W.	Mean Amount of Ozone.	Mean Amount of Cloud.	Rain. Mean Number of Days it fell.	Rain. Mean Amount collected.
	ft.	in.	°	°	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°									in.
1	48	30·3	32·0	36·8	25·0	11·8	35·0	27·4	7·6	5·9	29·4	26·4	·218	2·6	0·6	85	385	—	—	1·6	4	8	11	7	3·5	6·6	63	5·72
2	68	30·2	37·0	49·0	26·8	22·2	44·5	31·3	12·3	9·6	35·6	33·0	·231	3·4	0·8	91	386	61·9	40·6	2·1	5	8	11	7	6·4	6·5	58	1·76
3	68	30·2	33·0	45·0	24·6	20·4	35·8	32·0	8·8	4·9	33·8	32·5	·206	3·0	0·6	86	389	—	—	2·3	5	9	9	8	—	7·1	63	2·06
4	67	30·2	37·0	49·0	24·6	24·4	44·5	29·3	10·1	4·9	36·6	33·0	·220	3·6	0·4	91	390	—	43·9	1·4	5	9	9	7	—	7·4	59	1·48
	71	30·2	34·1	41·5	27·0	14·4	37·0	31·4	10·3	6·0	33·9	32·3	·213	3·2	0·5	89	389	—	—	1·8	5	9	9	7	7·1	—	61	1·76
5	69	30·2	37·1	42·1	33·4	8·7	42·6	32·7	10·8	4·8	35·4	·306	3·5	0·4	91	379	75·8	30·4	0·2	6	7	11	7	—	7·6	56	1·23
6	45	30·3	34·1	41·2	31·2	10·0	43·7	32·4	9·5	4·8	34·4	·294	3·4	0·5	85	380	—	—	—	8	6	9	8	—	8·6	54	1·46
7	69	30·2	29·0	40·0	20·2	19·8	39·4	26·4	7·8	4·8	32·4	·277	3·4	0·6	84	389	—	—	41·3	1·2	7	8	10	6	—	7·8	43	1·09
8	68	30·3	39·8	52·7	44·4	8·3	48·4	44·6	7·8	4·6	42·6	·296	3·4	0·5	87	389	—	—	41·6	1·6	8	5	12	8	—	7·2	54	1·75
9	74	30·2	29·0	52·1	33·6	18·5	41·8	37·5	12·0	4·7	38·8	·310	3·4	0·3	95	391	60·1	38·7	0·2	5	8	11	6	—	7·4	54	1·42
10	75	30·1	21·0	34·0	20·4	13·6	30·3	14·5	16·2	10·3	28·6	·286	3·2	0·4	90	390	72·1	37·1	1·4	7	7	8	—	—	7·2	69	2·47
11	73	30·1	25·5	39·5	23·1	16·4	33·1	18·0	15·2	10·2	29·7	44·1	·293	3·4	0·7	85	390	—	—	1·3	3	9	13	5	—	7·8	57	1·67
12	90	30·0	26·0	40·0	20·4	19·6	35·9	19·2	16·7	10·2	30·1	43·4	·284	3·2	0·4	89	389	—	—	1·8	6	6	11	8	—	7·2	59	1·72
13	63	30·2	29·0	44·0	23·7	20·3	37·5	24·0	13·5	8·5	33·6	44·6	·297	3·4	0·6	87	391	78·2	34·1	1·9	7	6	10	8	—	7·3	42	1·08
14	90	30·1	27·2	44·5	22·3	22·2	41·3	24·8	16·5	11·0	31·6	43·4	·284	3·2	0·4	89	390	70·2	36·5	0·6	7	6	10	7	2·2	7·4	54	1·33
15	74	30·0	23·0	40·0	21·9	18·1	32·0	22·0	11·0	6·2	32·2	·283	3·3	0·4	89	389	65·6	36·6	0·7	6	7	13	5	0·7	7·2	57	1·66
16	77	30·0	25·0	52·0	24·7	27·3	40·6	27·9	14·1	4·5	33·0	·286	3·1	0·5	87	389	58·6	37·4	0·1	6	8	11	7	—	7·2	50	1·30
17	70	30·0	23·9	44·4	21·7	22·7	41·0	23·4	10·7	4·9	32·3	·281	3·2	0·4	89	389	76·2	36·4	0·2	7	7	9	8	—	7·7	53	1·39
18	73	30·0	27·2	46·4	22·9	23·5	41·6	25·4	11·3	4·7	34·0	·271	3·1	0·6	84	389	73·2	35·4	0·5	5	7	12	7	—	7·4	52	1·37
																											67	1·16
19	72	30·1	22·0	36·3	20·9	15·4	33·9	20·9	13·0	4·7	27·4	·279	3·2	0·5	85	389	75·5	37·5	1·0	5	7	9	10	—	7·9	47	1·63
20	71	30·2	27·6	45·6	23·5	22·1	42·6	25·1	10·7	4·7	34·2	·287	3·2	0·5	87	389	73·6	38·8	—	8	4	9	9	—	7·6	55	1·72
21	68	30·2	24·1	41·3	22·1	19·2	32·6	23·4	9·4	4·7	32·8	·284	3·2	0·5	87	389	74·1	36·2	0·6	6	8	10	7	1·2	7·9	55	1·73
22	70	30·3	21·5	40·0	20·5	19·5	37·7	19·6	17·2	4·7	29·6	·272	3·2	0·4	89	389	72·2	34·6	0·4	4	7	8	11	—	7·9	48	1·26
23	69	30·3	23·0	44·5	22·3	22·2	40·4	24·9	11·9	4·7	33·2	·278	3·2	0·4	88	389	—	—	—	4	6	14	6	—	7·2	60	1·62
24	69	30·0	25·0	44·0	21·6	22·4	40·4	23·7	11·2	4·6	33·2	·283	3·2	0·4	89	389	77·0	34·9	1·2	5	7	11	8	—	7·5	45	1·19
25	71	30·0	24·0	43·5	22·8	20·7	39·4	23·3	12·9	4·7	33·7	·274	3·1	0·4	89	389	76·2	36·2	1·5	6	7	12	6	—	7·4	52	1·45
26	69	30·1	17·0	31·3	15·2	16·1	29·4	17·3	12·9	4·7	23·2	·273	3·1	0·4	89	389	—	—	—	5	11	10	5	—	—	61	1·06
27	71	30·2	26·5	45·0	21·4	23·6	43·4	23·4	8·0	4·7	34·5	·267	3·5	0·2	94	389	—	—	—	3	10	12	5	—	—	53	1·23
28	68	30·2	30·5	42·4	30·8	11·6	39·2	32·5	8·9	4·6	36·2	·276	3·1	0·5	87	389	72·7	35·1	1·0	5	9	11	6	—	7·8	56	1·53
29	69	30·2	24·0	42·2	21·4	20·8	39·1	21·1	9·4	4·6	31·4	·290	3·3	0·3	92	389	72·0	37·9	0·4	5	8	10	7	1·0	7·4	54	1·69
30	69	30·1	25·8	43·0	21·4	21·6	40·6	23·8	10·8	4·5	33·2	·270	3·1	0·5	88	389	69·3	38·1	0·4	5	10	10	6	2·5	7·4	54	1·69
31	69	30·2	20·3	40·0	17·3	22·7	37·4	19·6	18·5	4·5	29·5	·255	3·0	0·3	86	389	64·4	38·3	1·6	4	7	15	5	—	7·4	49	1·33
32	69	30·2	26·0	38·3	23·2	15·1	29·6	24·4	8·4	4·7	32·2	·267	3·0	0·4	92	389	—	—	0·7	2	6	13	9	—	7·7	56	1·70
33	67	30·2	29·3	47·1	19·0	28·1	43·5	25·0	8·9	4·2	34·2	·267	3·0	0·4	92	389	75·4	36·5	0·9	4	8	13	6	0·7	7·8	57	1·83
34	67	30·2	28·9	38·9	30·0	12·1	37·9	7·9	45·8	41·9	·268	3·1	0·5	86	390	—	—	1·2	4	14	9	4	—	7·2	53	1·72
35	73	30·1	21·3	30·1	15·6	14·5	29·6	17·6	12·0	4·7	23·4	·261	3·0	0·3	85	389	55·0	32·5	0·3	4	9	12	6	1·1	7·3	55	1·79
36	67	30·0	24·8	42·2	18·4	23·8	39·8	21·5	8·6	4·5	29·0	·254	2·9	0·4	88	389	66·0	—	0·4	4	11	8	8	—	7·6	48	1·58
37	67	30·0	27·0	40·0	19·8	21·0	39·3	8·2	45·8	42·0	·270	3·1	0·5	87	389	57·4	38·9	—	—	—	—	—	—	1·4	—	54	1·75
38	67	30·2	21·3	45·5	21·7	23·8	41·0	23·9	10·7	4·5	31·8	·267	3·0	0·3	86	389	70·1	37·8	—	6	9	8	8	—	8·4	57	1·93
39	72	30·0	29·0	42·9	30·4	12·5	41·7	31·0	8·7	46·2	42·1	·270	3·1	0·6	85	389	57·5	—	1·4	5	9	9	7	—	6·1	57	1·78
40	65	30·0	25·0	39·0	18·9	20·1	37·2	17·0	45·4	40·4	·252	2·9	0·6	83	388	56·4	—	1·1	6	10	8	6	—	8·0	56	1·64
41	69	30·2	21·7	47·9	20·4	27·5	42·0	24·5	8·3	45·6	41·0	·259	3·0	0·3	84	389	60·6	32·5	0·4	4	10	10	6	1·6	6·6	55	1·69
	—	—	18·3	—	—	—	37·0	—	—	—	—	—	—	—	—	—	71·4	33·1	1·2	4	10	10	6	—	7·3	61	1·87
42	70	30·1	30·0	41·2	31·2	10·0	40·1	33·0	11·1	45·1	41·5	·263	3·0	0·6	87	389	68·3	36·2	1·2	2	11	10	8	7·6	8·3	52	1·73
43	66	30·1	17·6	32·0	10·1	21·9	38·5	17·4	11·5	44·1	40·4	·253	2·9	0·5	87	389	62·3	33·6	1·4	5	11	10	5	4·6	7·1	50	1·74
44	68	30·0	25·0	43·0	20·4	22·6	41·0	20·5	8·8	45·3	39·8	·250	2·9	0·6	82	389	57·6	35·3	1·5	2	12	7	10	—	6·8	61	1·77
45	67	30·0	26·0	40·0	24·8	15·2	40·0	25·3	8·2	44·5	40·7	·257	2·9	0·5	87	389	—	—	1·7	7	6	9	9	—	7·1	62	1·89
46	65	30·0	24·0	42·0	20·0	22·0	40·4	20·3	9·6	45·0	41·2	·251	3·0	0·5	84	389	72·6	35·1	1·7	5	10	13	3	—	5·7	61	1·84

Extremes of the air were at Caterham, 80°·0; East Tilbury, 77°·0; and at Salisbury, 75°·0.
Extremes of the air were at Carlisle, 17°·6; Lampeter, 18°·0; and at Allenheads, 18°·3.
Ranges of the temperatures of the air were at Salisbury, 14°·5; East Tilbury, 14°·1; and at Chiswick, 14°·3.
Means of the temperatures of the air were at Bradford, 79°·0; Guernsey, 78°·6; and at Brighton, 78°·5.
Number of rainy days were at Nottingham, 74; North Shields, 69; and at Calcethorpe, 67.
Number of rainy days were at Ramsgate, 42; Brighton, 45; and at Streatley and Chiswick, both 47.
Amount of rain were at Truro, 20·61 inches; Guernsey, 20·27 inches; and at Lampeter, 19·44 inches.
Amounts were at Holkham, 7·21 inches; Norwich, 7·33 inches; and at Wisbech, 7·49 inches.

QUARTERLY METEOROLOGICAL TABLE for different PARALLELS of LATITUDE.

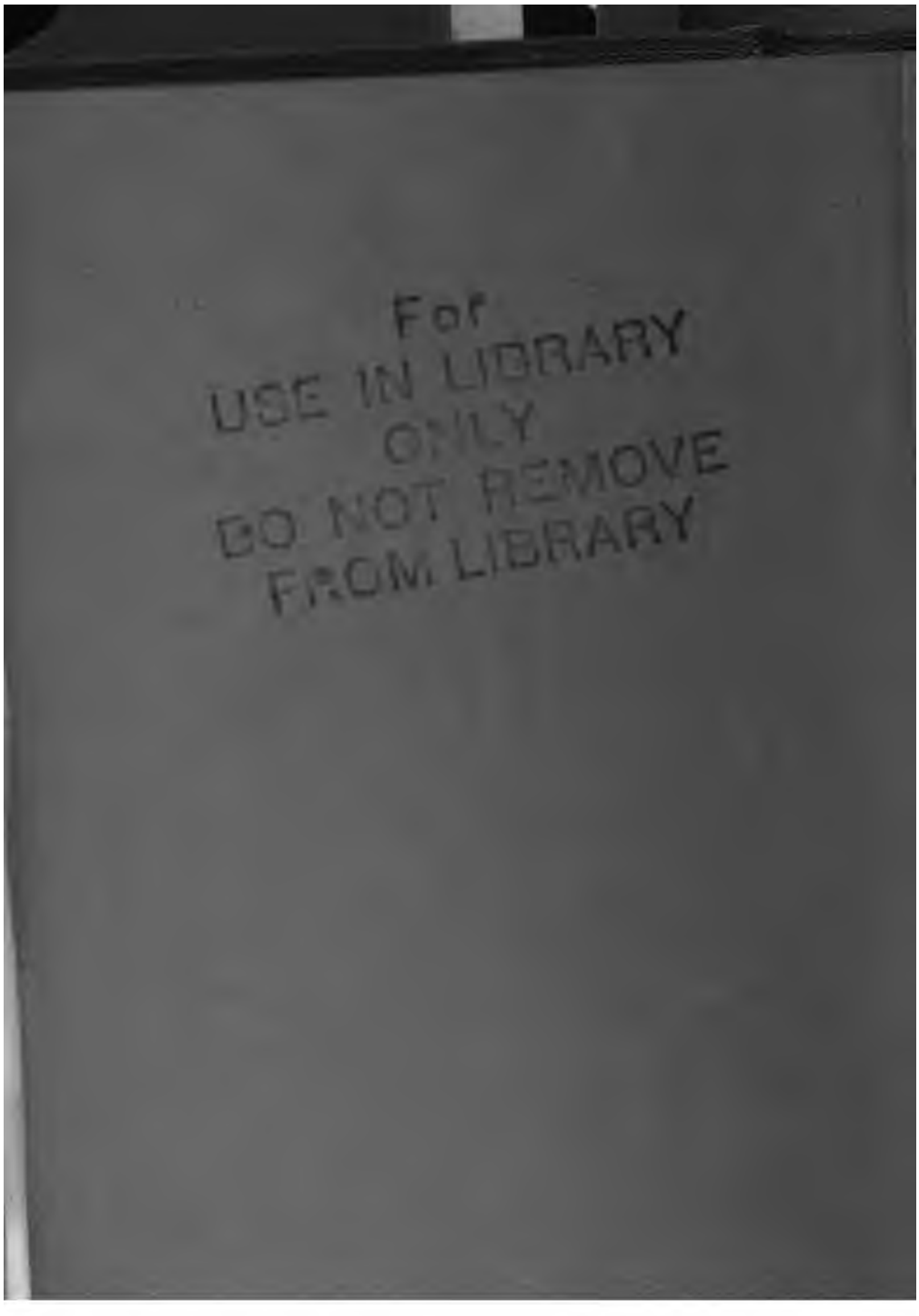
Height above Sea-level.	Air reduced to the level of the sea.	Mean of all Highest Readings of the Thermometer.	Mean of all Lowest Readings of the Thermometer.	Mean Range of Temperature in the Quarter.	Mean of all Highest.	Mean of all Lowest.	Mean Monthly Range of Temperature.	Mean Daily Range of Temperature.	Mean Temperature of the Air.	Mean Temperature of the Dew Point.	Mean Elastic Force of Vapour.	Mean Weight of Vapour in a cubic foot of Air.	Mean additional Weight required for saturation.	Mean degree of Humidity.	Mean Weight of a cubic foot of Air.	Mean Reading of Maximum in Rays of Sun.	Mean Reading of Minimum on Grass.	Wind. Mean Estimated Strength.	Wind. Relative Proportion of N.	Wind. Relative Proportion of E.	Wind. Relative Proportion of S.	Wind. Relative Proportion of W.	Mean Amount of Ozone.	Mean Amount of Cloud.	Rain. Mean Number of Days it fell.	Rain. Mean Amount collected.
ft.	in.	°	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°									in.
48	30·3	32·0	36·8	25·0	11·8	35·0	27·4	7·6	5·9	29·4	26·4	·218	2·6	0·6	85	385	—	—	1·6	4	8	11	7	3·5	6·6	63	5·72
68	30·2	37·0	49·0	26·8	22·2	44·5	31·3	12·3	9·6	35·6	33·0	·231	3·4	0·8	91	386	61·9	40·6	2·1	5	8	11	7	6·4	6·5	58	1·76
68	30·2	33·0	45·0	24·6	20·4	35·8	32·0	8·8	4·9	33·8	32·5	·206	3·0	0·6	86	389	—	—	2·3	5	9	9	8	—	7·1	63	2·06
67	30·2	37·0	49·0	24·6	24·4	44·5	29·3	10·1	4·9	36·6	33·0	·220	3·6	0·4	91	390	—	43·9	1·4	5	9	9	7	—	7·4	59	1·48
71	30·2	34·1	41·5	27·0	14·4	37·0	31·4	10·3	6·0	33·9	32·3	·213	3·2	0·5	89	389	—	—	1·8	5	9	9	7	7·1	—	61	1·76
69	30·2	37·1	42·1	33·4	8·7	42·6	32·7	10·8	4·8	35·4	·306	3·5	0·4	91	379	75·8	30·4	0·2	6	7	11	7	—	7·6	56	1·23
45	30·3	34·1	41·2	31·2	10·0	43·7	32·4	9·5	4·8	34·4	·294	3·4	0·5	85	380	—	—	—	8	6	9	8	—	8·6	54	1·46
69	30·2	29·0	40·0	20·2	19·8	39·4	26·4	7·8	4·8	32·4	43·7	·277	3·4	0·6	84	389	—	—	1·2	7	8	10	6	—	7·8	43	1·09
68	30·3	39·8	52·7	44·4	8·3	48·4	44·6	7·8	4·6	42·6	·296	3·4	0·5	87	389	—	—	1·6	8	5	12	8	—	7·2	54	1·75
74	30·2	29·0	52·1	33·6	18·5	41·8	37·5	12·0	4·7	38·8	·310	3·4	0·3	95	391	60·1	38·7	0·2	5	8	11	6	—	7·4	54	1·42
75	30·1	21·0	34·0	20·4	13·6	30·3	14·5	16·2	10·3	28·6	·286	3·2	0·4	90	390	72·1	37·1	1·4	7	7	8	—	—	7·2	69	2·47
73	30·1	25·5	39·5	23·1	16·4	33·1	18·0	15·2	10·2	29·7	44·1	·293	3·4	0·7	85	390	—	—	1·3	3	9	13	5	—	7·8	57	1·67
90	30·0	26·0	40·0	20·4	19·6	35·9	19·2	16·7	10·2	30·1	43·4	·284	3·2	0·4	89	389	—	—	1·8	6	6	11	8	—	7·2	59	1·72
63	30·2	29·0	44·0	23·7	20·3	37·5	24·0	13·5	8·5	33·6	44·6	·297	3·4	0·6	87	391	78·2	34·1	1·9	7	6	10	8	—	7·3	42	1·08
90	30·1	27·2	44·5	22·3	22·2	41·3	24·8	16·5	11·0	31·6	43·4	·284	3·2	0·4	89	390	70·2	36·5	0·6	7	6	10	7	2·2	7·4	54	1·33
74	30·0	23·0	40·0	21·9	18·1	32·0	22·0	11·0	6·2	32·2	·283	3·3	0·4	89	389	65·6	36·6	0·7	6	7	13	5	0·7	7·2	57	1·66
77	30·0	25·0	52·0	24·7	27·3	40·6	27·9	14·1	4·5	33·0	·286	3·1	0·5	87	389	58·6	37·4	0·1	6	8	11	7	—	7·2	50	1·30
70	30·0	23·9	44·4	21·7	22·7	41·0	23·4	10·7	4·9	32·3	·281	3·2	0·4	89	389	76·2	36·4	0·2	7	7	9	8	—	7·7	53	1·39
73	30·0	27·2	46·4	22·9	23·5	41·6	25·4	11·3	4·7	34·0	·271	3·1	0·6	84	389	73·2	35·4	0·5	5	7	12	7	—	7·4	52	1·37
																									67	1·16
72	30·1	22·0	36·3	20·9	15·4	33·9	20·9	13·0	4·7	27·4	·279	3·2	0·5	85	389	75·5	37·5	1·0	5	7	9	10	—	7·9	47	1·63
71	30·2	27·6	45·6	23·5	22·1	42·6	25·1	10·7	4·7	34·2	·287	3·2	0·5	87	389	73·6	38·8	—	8	4	9	9	—	7·6	55	1·72
68	30·2	24·1	41·3	22·1	19·2	32·6	23·4	9·4	4·7	32·8	·284	3·2	0·5	87	389	74·1	36·2	0·6	6	8	10	7	1·2	7·9	55	1·73
70	30·3	21·5	40·0	20·5	19·5	37·7	19·6	17·2	4·7	29·6	·272	3·2	0·4	89	389	72·2	34·6	0·4	4	7	8	11	—	7·9	48	1·26
69	30·3	23·0	44·5	22·3	22·2	40·4	24·9	11·9	4·7	33·2	·278	3·2	0·4	88	389	—	—	—	4	6	14	6	—	7·2	60	1·62
69	30·0	25·0	44·0	21·6	22·4	40·4	23·7	11·2	4·6	33·2	·283	3·2	0·4	89	389	77·0	34·9	1·2	5	7	11	8	—	7·5	45	1·19
71	30·0	24·0	43·5	22·8	20·7	39·4	23·3	12·9	4·7	33·7	·274	3·1	0·4	89	389	76·2	36·2	1·5	6	7	12	6	—	7·4	52	1·45
69	30·1	17·0	31·3	15·2	16·1	29·4	17·3	12·9	4·7	23·2	·273	3·1	0·4	89	389	—	—	—	5	11	10	5	—	—	61	1·06
71	30·2	26·5	45·0	21·4	23·6	43·4	23·4	8·0	4·7	34·5	·267	3·5	0·2	94	389	—	—	—	3	10	12	5	—	—	53	1·23
68	30·2	30·5	42·4	30·8	11·6	39·2	32·5	8·9	4·6	36·2	·276	3·1	0·5	87	389	72·7	35·1	1·0	5	9	11	6	—	7·8	56	1·53
69	30·2	24·0	42·2	21·4	20·8	39·1	21·1	9·4	4·6	31·4	·290	3·3	0·3	92	389	72·0	37·9	0·4	5	8	10	7	1·0	7·4	54	1·69
69	30·1	25·8	43·0	21·4	21·6	40·6	23·8	10·8	4·5	33·2	·270	3·1	0·5	88	389	69·3	38·1	0·4	5	10	10	6	2·5	7·4	54	1·69
69	30·2	20·3	40·0	17·3	22·7	37·4	19·6	18·5	4·5	29·5	·255	3·0	0·3	86	389	64·4	38·3	1·6	4	7	15	5	—	7·4	49	1·33
69	30·2	26·0	38·3	23·2	15·1	29·6	24·4	8·4	4·7	32·2	·267	3·0	0·4	92	389	—	—	0·7	2	6	13	9	—	7·7	56	1·70
67	30·2	29·3	47·1	19·0	28·1	43·5	25·0	8·9	4·2	34·2	·267	3·0	0·4	92	389	75·4	36·5	0·9	4	8	13	6	0·7	7·8	57	1·83
67	30·2	28·9	38·9	30·0	12·1	37·9	7·9	45·8	41·9	·268	3·1	0·5	86	390	—	—	1·2	4	14	9	4	—	7·2	53	1·72
73	30·1	21·3	30·1	15·6	14·5	29·6	17·6	12·0	4·7	23·4	·261	3·0	0·3	85	389	55·0	32·5	0·3	4	9	12	6	1·1	7·3	55	1·79
67	30·0	24·8	42·2	18·4	23·8	39·8	21·5	8·6	4·5	29·0	·254	2·9	0·4	88	389	66·0	—	0·4	4	11	8	8	—	7·6	48	1·58
67	30·0	27·0	40·0	19·8	21·0	39·3	8·2	45·8	42·0	·270	3·1	0·5	87	389	57·4	38·9	—	—	—	—	—	—	1·4	—	54	1·75
67	30·2	21·3	45·5	21·7	23·8	41·0	23·9	10·7	4·5	31·8	·267	3·0	0·3	86	389	70·1	37·8	—	6	9	8	8	—	8·4	57	1·93
72	30·0	29·0	42·9	30·4	12·5	41·7	31·0	8·7	46·2	42·1	·270	3·1	0·6	85	389	57·5	—	1·4	5	9	9	7	—	6·1	57	1·78
65	30·0	25·0	39·0	18·9	20·1	37·2	17·0	45·4	40·4	·252	2·9	0·6	83	388	56·4	—	1·1	6	10	8	6	—	8·0	56	1·64
69	30·2	21·7	47·9	20·4	27·5	42·0	24·5	8·3	45·6	41·0	·259	3·0	0·3	84	389	60·6	32·5	0·4	4	10	10	6	1·6	6·6	55	1·69
—	—	18·3	—	—	—	37·0	—	—	—	—	—	—	—	—	—	71·4	33·1	1·2	4	10	10	6	—	7·3	61	1·87
70	30·1	30·0	41·2	31·2	10·0	40·1	33·0	11·1	45·1	41·5	·263	3·0	0·6	87	389	68·3	36·2	1·2	2	11	10	8	7·6	8·3	52	1·73
66	30·1	17·6	32·0	10·1	21·9	38·5	17·4	11·5	44·1	40·4	·253	2·9	0·5	87	389	62·3	33·6	1·4	5	11	10	5	4·6	7·1	50	1·74
68	30·0	25·0	43·0	20·4	22·6	41·0	20·5	8·8	45·3	39·8	·250	2·9	0·6	82	389	57·6	35·3	1·5	2	12	7	10	—	6·8	61	1·77
67	30·0	26·0	40·0	24·8	15·2	40·0	25·3	8·2	44·5	40·7	·257	2·9	0·5	87	389	—	—	1·7	7	6	9	9	—	7·1	62	1·89
65	30·0	24·0	42·0	20·0	22·0	40·4	20·3	9·6	45·0	41·2	·251	3·0	0·5	84	389	72·6	35·1	1·7	5	10	13	3	—	5·7	61	1·84
69	30·2	29·5	44·5	31·9	12·6	41·8	33·1	10·1	46·5	42·8	·278	3·2	0·5	87	389	68·6	37·0	1·1	5	8	10	7	6·2	7·1	57	1·74
70	30·1	24·9	44·6	31·9	12·7	41·8	33·1	10·1	46·3	42·8	·278	3·2	0·5	87	389	68·6	37·0	1·1	5	8	10	7	6·2	7·1	57	1·74

NAMES OF STATIONS.	Mean Pressure of dry Air reduced to the level of the Sea.	Highest Reading of the Thermometer.	Lowest Reading of the Thermometer.	Range of Temperature in the Quarter.	Mean of all Highest.	Mean of all Lowest.	Mean Monthly Range of Temperature.	Mean Daily Range of Temperature.	Mean Temperature of the Air.	Mean Temperature of the Dew Point.	Mean Elastic Force of Vapour.	Mean Weight of Vapour in a cubic foot of Air.	Mean additional Weight required for saturation.	Mean degree of Humidity.	Mean Weight of a cubic foot of Air.	Mean Reading of Maximum in Rays of Sun.	Mean Reading of Minimum on Grass.	Wind. Mean Estimated Strength.	Wind. Relative Proportion of N.	E.	S.	W.	Mean Amount of Ozone.	Mean Amount of Cloud.	Rain. Number of Days on which it fell.	Rain. Amount collected.
	in.	°	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°									in.
Guernsey	29·431	68·5	32·0	36·5	55·0	47·4	25·0	7·6	50·9	46·4	·318	3·6	0·6	85	535	—	—	1·6	4	8	11	7	3·5	6·6	63	20·27
Helston	29·389	68·0	28·0	40·0	56·8	44·5	34·3	12·3	50·6	45·0	·331	3·4	0·8	81	536	63·9	40·6	2·1	5	8	11	7	6·4	6·5	58	16·96
Truro	29·400	68·0	23·0	45·0	54·6	45·8	32·0	8·8	49·8	45·5	·306	3·5	0·6	86	539	—	—	2·3	5	9	9	8	—	7·1	63	20·66
Plymouth	29·469	67·0	27·0	40·0	54·6	44·5	29·3	10·1	49·3	46·6	·320	3·6	0·4	91	540	—	43·9	1·4	5	9	9	7	—	7·4	59	17·44
Ventnor	—	71·0	29·1	41·9	57·0	46·4	33·0	10·6	50·6	46·8	·323	3·6	0·6	87	540	—	—	—	—	—	—	—	7·1	—	54	13·65
Osborne	29·450	69·2	27·1	42·1	53·4	42·6	32·7	10·8	48·1	45·4	·307	3·5	0·4	91	539	75·8	30·4	0·2	6	7	11	7	—	7·6	58	19·77
Bournemouth	29·483	65·3	24·1	41·2	53·2	43·7	32·4	9·5	48·4	44·4	·294	3·4	0·5	86	540	—	—	—	8	6	9	8	—	5·6	54	14·45
Brighton	29·494	69·0	29·0	40·0	52·7	44·9	30·4	7·8	48·4	43·7	·295	3·4	0·6	84	539	—	41·3	1·2	7	8	10	6	—	7·5	45	10·69
Hastings	29·481	68·3	26·5	39·8	52·7	44·4	30·1	8·3	48·4	44·6	·296	3·4	0·5	87	539	—	41·6	1·6	8	5	12	6	—	7·2	54	12·75
Taunton	29·422	74·0	22·0	52·0	53·8	41·8	37·5	12·0	47·8	45·8	·310	3·4	0·3	93	541	60·1	38·7	0·2	5	8	11	6	2·4	7·3	54	14·32
Salisbury	29·450	75·0	21·0	54·0	53·4	38·0	39·5	14·5	46·2	45·5	·286	3·2	0·4	90	540	72·1	37·1	1·4	7	7	8	—	—	7·2	60	14·98
Barnstaple	29·415	73·0	25·5	49·5	55·1	44·9	30·7	10·2	49·7	44·1	·293	3·4	0·7	85	540	—	—	1·3	3	9	13	5	—	4·8	59	14·02
Caterham	29·323	80·0	29·0	50·0	59·4	39·8	38·3	10·6	45·8	42·5	·276	3·2	0·4	89	533	—	—	1·8	6	6	11	5	0·5	5·9	52	13·62
Ramsgate	29·490	69·6	29·0	45·6	52·8	44·3	32·8	8·5	48·6	44·6	·297	3·4	0·6	87	541	78·2	34·1	1·9	7	6	10	8	—	7·3	42	10·08
Strathfield Turgiss	29·479	69·7	25·2	44·5	52·3	41·3	34·8	11·0	46·6	43·4	·284	3·2	0·4	89	540	76·2	36·5	0·6	7	6	10	7	2·2	7·4	54	11·35
Weybridge Heath	29·501	72·0	23·0	49·0	51·9	40·9	35·0	11·0	46·2	43·2	·283	3·3	0·4	89	542	65·6	36·6	0·7	6	7	13	5	0·8	7·2	57	19·33
East Tilbury	29·502	77·0	25·0	52·0	54·7	40·6	37·9	14·1	47·5	44·0	·290	3·1	0·5	87	543	58·6	37·4	0·1	6	6	11	7	—	7·2	50	8·91
Marlborough Green	29·447	70·3	25·9	44·4	51·7	41·0	33·4	10·7	45·9	43·1	·281	3·2	0·4	90	535	76·2	36·4	0·2	7	7	9	8	—	7·7	55	13·90
Blackheath	29·490	73·6	27·2	46·4	52·9	41·6	35·4	11·3	47·0	42·2	·271	3·1	0·6	83	54·	75·2	39·4	0·5	5	7	12	7	—	7·4	52	10·77
Streatley Vicarage	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	47	9·95
Chiswick	29·499	72·5	22·0	50·5	53·9	39·9	38·7	14·0	47·1	42·8	·279	3·2	0·5	85	543	75·5	37·5	1·0	5	7	9	10	—	7·9	47	9·82
Camden Square	29·461	71·2	27·0	43·6	52·5	42·3	33·1	10·2	47·2	43·7	·287	3·2	0·5	87	541	73·8	38·8	—	8	4	9	9	—	7·5	53	10·72
Oxford	29·455	69·6	24·1	41·5	52·1	42·7	32·6	9·4	47·2	43·4	·284	3·2	0·5	87	539	75·1	36·2	0·6	6	8	10	7	1·2	7·9	55	9·38
Gloucester	29·478	70·5	21·5	49·0	53·5	40·9	37·7	12·6	47·2	44·2	·293	3·3	0·4	89	542	72·2	34·6	0·4	4	7	8	11	2·0	7·0	48	11·89
Royston	29·482	69·9	25·0	44·9	52·3	40·4	34·9	11·9	46·2	42·9	·278	3·2	0·4	89	540	—	—	—	4	6	14	6	—	7·2	60	9·02
Cardington	29·483	69·0	25·0	44·0	51·6	40·4	33·7	11·2	46·0	43·2	·283	3·2	0·4	90	543	77·0	34·9	1·2	5	7	11	8	—	7·5	48	8·80
Cambridge	29·457	71·3	23·0	45·5	52·8	41·3	34·7	11·3	47·1	43·8	·289	3·3	0·4	89	541	77·5	36·2	1·3	6	7	12	6	—	7·4	59	8·05
Lampeter	29·464	69·5	18·0	51·5	52·5	39·4	37·5	12·9	45·7	42·6	·275	3·1	0·4	89	537	68·0	—	—	5	11	10	5	—	—	60	19·44
Norwich	29·455	71·8	26·5	45·3	51·4	43·4	30·4	8·0	47·0	45·5	·307	3·5	0·2	94	543	—	—	—	3	10	12	5	—	—	53	7·33
Leicester	29·469	68·9	26·5	42·4	50·8	41·0	32·5	8·9	46·2	42·6	·276	3·1	0·5	87	539	72·7	35·1	1·0	5	9	11	6	—	7·8	56	9·53
Wisbech	29·439	69·2	24·0	43·2	51·4	42·0	32·1	9·4	46·1	43·8	·290	3·3	0·3	92	544	72·0	37·9	0·4	5	8	10	7	1·9	7·4	54	7·69
Nottingham	29·437	69·7	25·8	43·9	51·4	40·6	33·8	10·8	45·7	42·1	·270	3·1	0·5	88	541	69·3	39·1	0·4	5	10	10	6	2·3	7·4	74	10·80
Holkham	29·468	69·3	29·3	40·0	51·3	37·7	33·4	13·6	45·5	41·5	·255	3·0	0·5	86	544	64·4	36·5	1·6	4	7	15	5	—	7·4	49	7·21
Llandudno	29·447	66·3	28·0	38·3	51·2	43·6	26·8	8·4	47·8	42·7	·275	3·2	0·7	82	539	—	—	0·7	2	6	13	9	—	7·7	56	12·74
Calcethorpe	29·481	67·4	29·3	47·1	49·0	40·1	33·5	8·9	44·2	41·7	·267	3·0	0·4	92	539	75·4	36·5	0·9	4	8	13	6	0·7	7·8	67	11·29
Liverpool	29·429	67·8	28·9	38·9	50·0	42·1	27·9	7·9	45·8	41·9	·268	3·1	0·5	86	540	—	—	1·2	4	14	9	4	—	7·2	53	11·72
Eccles	29·453	73·5	23·5	50·0	51·6	39·6	35·6	12·0	45·7	41·4	·263	3·0	0·5	85	542	55·0	32·5	0·3	4	9	12	6	1·1	7·3	55	11·39
Bermerside, Halifax	29·493	67·0	24·8	42·2	48·4	39·8	31·5	8·6	45·9	40·5	·254	2·9	0·4	88	547	66·0	—	0·4	4	11	8	8	—	7·6	48	17·21
Hull	29·471	67·0	27·0	40·0	49·8	41·6	29·3	8·2	45·8	42·0	·270	3·1	0·5	86	544	57·4	38·9	—	—	—	—	—	1·4	—	54	13·16
Stonyhurst	29·448	67·6	21·3	45·3	51·7	41·0	33·9	10·7	45·8	41·8	·267	3·0	0·5	86	547	76·1	37·8	—	6	9	8	8	—	8·4	57	10·41
Leeds	29·444	72·0	30·0	42·0	50·4	41·7	31·0	8·7	46·2	42·1	·270	3·1	0·6	85	542	57·5	—	1·4	5	9	9	7	—	6·1	57	12·58
Bradford	29·448	65·0	29·0	36·0	48·9	41·0	27·1	7·0	45·4	40·4	·252	2·9	0·6	83	538	56·4	—	1·1	6	10	8	6	—	8·0	56	14·64
Cockermouth	29·418	69·2	21·3	47·9	50·4	42·0	34·5	8·3	45·6	41·0	·259	3·0	0·5	84	541	60·6	32·3	0·4	4	10	10	6	1·8	6·6	55	10·39
Allenheads	—	—	18·3	—	—	36·0	—	—	—	—	—	—	—	—	—	71·4	33·1	1·2	4	10	10	6	—	7·3	65	15·97
Silloth	29·423	70·7	29·4	50·3	51·2	40·1	35·0	11·1	45·1	41·3	·263	3·0	0·6	87	544	68·3	36·2	1·2	2	11	10	8	7·6	5·3	52	10·78
Carlisle	29·451	69·6	17·6	52·0	50·2	38·5	37·4	11·8	44·1	40·4	·253	2·9	0·5	87	544	62·3	33·6	1·4	5	11	10	5	4·6	7·1	50	9·14
Bywell	29·429	68·0	25·0	43·0	50·4	41·6	30·3	8·8	45·3	39·8	·250	2·9	0·6	82	543	57·6	35·3	1·3	2	12	7	10	—	6·8	61	14·76
North Shields	—	65·0	29·0	36·0	48·8	40·6	25·2	8·2	44·5	40·7	·257	2·9	0·5	87	545	—	39·2	1·7	7	6	9	9	—	7·7	69	16·88
Milltown (Ireland)	29·373	65·0	23·0	42·0	50·0	40·4	29·3	9·6	45·0	41·2	·261	3·0	0·5	86	540	72·6	37·1	1·7	5	10	13	3	—	5·7	61	15·64

The highest temperatures of the air were at Caterham, 80°·0; East Tilbury, 77°·0; and at Salisbury, 75°·0.
The lowest temperatures of the air were at Carlisle, 17°·6; Lampeter, 18°·0; and at Allenheads, 18°·3.
The greatest daily ranges of the temperatures of the air were at Salisbury, 14°·5; East Tilbury, 14°·1; and at Chiswick, 14°·0.
The least daily ranges of the temperatures of the air were at Bradford, 7°·0; Guernsey, 7°·6; and at Brighton, 7°·5.
The greatest numbers of rainy days were at Nottingham, 74; North Shields, 69; and at Calcethorpe, 67.
The least numbers of rainy days were at Ramsgate, 42; Brighton, 45; and at Streatley and Chiswick, both 47.
The heaviest falls of rain were at Truro, 20·66 inches; Guernsey, 20·27 inches; and at Lampeter, 19·44 inches.
The least falls of rain were at Holkham, 7·21 inches; Norwich, 7·33 inches; and at Wisbech, 7·69 inches.

Quarterly Meteorological Table for different Parallels of Latitude.

PARALLELS OF LATITUDE, &c.	Mean Pressure of dry Air reduced to the level of the Sea.	Mean of all Highest Readings of the Thermometer.	Mean of all Lowest Readings of the Thermometer.	Mean Range of Temperature in the Quarter.	Mean of all Highest.	Mean of all Lowest.	Mean Monthly Range of Temperature.	Mean Daily Range of Temperature.	Mean Temperature of the Air.	Mean Temperature of the Dew Point.	Mean Elastic Force of Vapour.	Mean Weight of Vapour in a cubic foot of Air.	Mean additional Weight required for saturation.	Mean degree of Humidity.	Mean Weight of a cubic foot of Air.	Mean Reading of Maximum in Rays of Sun.	Mean Reading of Minimum on Grass.	Wind. Mean Estimated Strength.	Wind. Relative Proportion of N.	E.	S.	W.	Mean Amount of Ozone.	Mean Amount of Cloud.	Rain. Mean Number of Days it fell.	Rain. Mean Amount collected.
	in.	°	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°									in.
Guernsey	29·431	68·5	32·0	36·5	55·0	47·4	25·0	7·6	50·9	46·4	·318	3·6	0·6	85	535	—	—	1·6	4	8	11	7	3·5	6·6	63	20·27
Between 50° and 51°	29·448	68·2	27·0	41·2	54·4	44·6	31·8	9·8	48·2	45·3	·304	3·5	0·6	87	539	64·8	40·8	1·5	6	7	10	7	6·8	6·9	56	14·83
Between 51° and 52°	29·477	72·6	24·3	48·1	52·8	41·5	35·6	11·3	47·1	43·4	·285	3·2	0·5	87	540	72·0	37·2	0·9	6	7	10	8	1·3	7·0	52	11·41
Between 52° and 53°	29·465	69·8	24·3	45·5	51·7	40·8	33·7	10·9	46·2	43·1	·280	3·2	0·4	89	542	68·7	36·6	1·0	5	8	12	6	2·1	7·4	57	9·76
Between 53° and 54°	29·454	68·6	25·8	42·8	50·5	41·2	31·4	8·9	45·6	41·8	·267	3·1	0·5	86	540	64·6	36·5	0·8	4	9	10	7	2·4	7·4	56	12·62
Between 54° and 55°	29·434	68·5	22·7	45·8	50·2	40·8	32·9	9·4	45·1	40·6	·255	2·9	0·6	85	542	62·8	34·1	1·1	4	11	9	7	4·7	6·9	56	13·05
Mean for the Quarter, 50° to 55° — Year 1873	29·714	68·8	22·8	46·0	50·5	39·1	34·0	11·4	44·6	40·8	·256	2·9	0·5	87	546	66·1	38·5	1·0	5	5	8	12	3·2	6·6	45	6·82
" 1874	29·608	64·9	14·9	50·0	48·3	37·0	33·1	11·3	42·4	38·6	·242	2·8	0·5	86	547	63·1	31·5	1·2	7	5	8	11	5·3	8·7	55	10·90
" 1875	29·637	66·4	22·6	43·8	48·5	38·5	32·3	10·0	43·2	39·5	·246	2·8	0·5	87	547	63·0	34·5	1·2	7	8	7	9	2·7	7·4	54	11·20
" 1876	29·456	69·5	24·9	44·6	51·9	41·8	33·1	10·1	46·5	42·8	·278	3·2	0·5	87	541	66·6	37·0	1·1	5	8	10	7	3·5	7·1	55	12·34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